Electronic Trading-Partner Agreements (tpaML)

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Companies have not been able to tightly integrate their Web commerce application to their back-end systems.

- Dozens of complex ERP and business application systems
- 90% of the Fortune 1000 run on at least three different operating systems, further complicating business integration.

And few e-commerce Web sites are integrated with existing business systems today.

- Our own research indicates that as little as 2% of all e-commerce sites integrate with their back end systems.

Business integration is complex, time-consuming.

- "70% of the cost of writing an application is writing the infrastructure" -- Gartner
Solution

Streamline the process of setting up and doing business between businesses.

- Electronic Trading Partner Agreement (TPA)
  - "Trading Partner Markup Language" (tpaML)

- Business to Business Protocol Framework (BPF)
  - Run-time support for TPA
Inter-enterprise Integration

Trading Partner

No Shared Middleware

Long-Running Conversations

Untrusted Access

Back-end Integration

Workflow

Application

BP

Business Process

Application

BP

Application

BP

Application

BP

Application

Back-end Integration

Workflow

XML

TPAs

BPF: Business-to-business Protocol Framework
Cross-enterprise Application Integration

- **Heterogeneous applications and platforms**
  - Business partners not required to use same middleware

- **Loose coupling of business platforms**
  - Each party's internal processes independent of other parties
    - No party can lock resources at other parties
    - Logs provide needed correlations among parties

- **Untrusted application components**
  - Controlled & monitored
  - Policy constraints
    - E.g. when can a reservation be cancelled?
Electronic TPA

- Rules of interaction between independent businesses
- Independent of the internal business processes at each party
- XML document
  - Authoring tool (understands TPA semantics)
- Automatic generation of customization code at each party
  - Formal specification of TPA avoids misinterpretation
  - Assures that parties configured compatibly
## Key TPA Elements

<table>
<thead>
<tr>
<th>Overall properties</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification</td>
<td>TPA duration</td>
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<tr>
<td>Communication properties</td>
<td>Business partner info.</td>
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<tr>
<td>Security properties</td>
<td>HTTP</td>
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<td>Roles</td>
<td>Authentication, non-repudiation</td>
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<tr>
<td>Actions</td>
<td>Buyer, seller, broker</td>
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<td>Responsiveness</td>
<td>Reserve, modify</td>
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<tr>
<td>Sequencing rules</td>
<td>Timeout</td>
</tr>
<tr>
<td>Error handling</td>
<td>Modify after reserve</td>
</tr>
<tr>
<td>Comments</td>
<td>Retries, actions invoked</td>
</tr>
<tr>
<td></td>
<td>ID of accompanying paper contract</td>
</tr>
</tbody>
</table>
XML based TPA Structure

<TPA>
   <TPAInfo>
      <!--TPA name, participants, etc.-->
   </TPAInfo>
   <Transport>
      <!--communication, transport security-->
   </Transport>
   <DocExchange>
      <!--message formats, message security-->
   </DocExchange>
   <BusinessProtocol>
      <!--Action Menu for each party-->
   </BusinessProtocol>
</TPA>
TPA UML Model

Scott Hinkelman
Functional Layer Comparison

Layer
- Business Logic
- Business Protocol
- Doc Exchange
- Transport

ebXML
- Business Process
- Message Exchange
- TRP Messaging
- Transport Envelope

Implementation
- Application
- Business Protocol
- Delivery Channel

TPA
BPF

Configuration of partners
Roles

- TPA may be in terms of actual parties or roles
  - Example of roles: buyer, seller
- Roles used to build prototype TPAs
- Authoring tool or registration tool resolves roles
  - Replace roles by specific parties everywhere in TPA
  - Fill in party-specific information such as addresses

<Role>
  <RoleDefn> <!--1 for each party-->
    <RoleName>obibuyer</RoleName>
    <RolePlayer>IBM</RolePlayer>
  </RoleDefn>
</Role>
Key Transport Elements

- Communication
  - Protocol
    - HTTP, SMTP, FTP, VAN-EDI
  - Addresses

- Transport Security
  - Encryption definition
  - Authentication definition
  - Certificates
    - Each party's certificate URL
    - Certificate authorities' certificate URLs
    - Key length
Key Document-Exchange Elements

- Message encoding
- Option to check for duplicate messages
- Message Retries
- Message security
  - Nonrepudiation
    - certificates
  - Digital envelope
    - certificates
Delivery Channel

- Combination of
  - One transport definition
  - One doc exchange definition

- Multiple delivery channels in TPA
  - Dynamically selected for each message
  - Statically bound to individual actions
Elements of Action Definition

- Request name
- Request message (schema)
- Delivery channel
- Reply name
- Exception reply name
- Maximum allowed service time
- Sequencing rules
Action Examples

Actions in a TPA are defined by the business application, not mandated by the TPA standard.

- **Actions in a procurement TPA**
  - Process purchase order
  - Modify purchase order
  - Cancel purchase order

- **Actions in an airline reservation TPA**
  - Reservation request
  - Modify reservation
  - Cancel reservation
  - Confirm reservation
Action Definition

<Action>
  <Request>
    <RequestName>processOBIPOR</RequestName>
    <RequestMessage>OBIPOR</RequestMessage>
    <Channel ChannelID="name" />
  </Request>
  <Response>
    <ResponseName>name</ResponseName>
  </Response>
  <ExceptionResponse>
    <ExceptionResponseName>name</ExceptionResponseName>
    ...<ResponseServiceTime>
      <ServiceTime>time</ServiceTime>
    </ResponseServiceTime>
    <Sequencing>
      ...
    </Sequencing>
  </ExceptionResponse>
</Action>
Sequencing Rules

- Directly under Service Interface tag
  <StartEnabled>
    <RequestName>action_name</RequestName>
    <!--one for each action allowed as initial action-->
  </StartEnabled>

- Inside Action Definition
  <Sequencing>
    <Enable> <!--actions permitted after this one-->
      <RequestName>name_of_action</RequestName>
      <!--one or more-->  
    </Enable>
    <Disable> <!--actions not permitted after this one-->
      <RequestName>name_of_action</RequestName>
      <!--one or more-->  
    </Disable>
  </Sequencing>
BP MetaModel, Ver. 2.0
and tpaML

<RequestMessage>
<RequestName>
<ServiceInterface>
<RoleName>, <Member>, <Party>
<Sequencing>
Conversation
<Sequencing>
<RequestMessage>
<RequestName>
<Delivery Channels>
<Dictionary>
<BusinessMessageInterface>
<BusinessDocument>
<InformationEntity>
<Fundamental Information Entity>
These layers will be defined by Core Components
Long-Running Conversation

- Conversation is unit of business under a TPA
  - Sequence of related actions
  - Asynchronous or synchronous messages
  - Each party maintains history and enforces TPA
  - Each party maintains correlations across conversations
  - Each party invokes their own internal business logic
Some BPF Services

- TPA Registration
- Message Routing
- Sequencing Rules
- Business document generation and parsing
- Security
- Correlation of conversations
- Logging
- Recovery
BPF Functional Layers

TPA

<table>
<thead>
<tr>
<th>BUSINESS LOGIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUSINESS PROTOCOL LAYER</td>
</tr>
<tr>
<td>DOC EXCHANGE LAYER</td>
</tr>
<tr>
<td>TRANSPORT LAYER</td>
</tr>
</tbody>
</table>

BPF
Business Setup, Operations Components

TPA Registration
- Mapping Info
- Code generation
- Runtime info
- Business Logic Registration
- Helper Registration

Pre-defined (e.g., OBI) or private XML based B-B interaction protocol

TPA Authoring Tool (GUI based)

Business Logic

B2BIF Manager
- Registration DB

Recovery Mgmt

B2BIF manages (i.e., creates, recovers, provide execution thread, etc.) TPA instances (objects)

Transport

DocXchange

Business Protocol

Business Logic

Order Management Framework
- Back-end processes

Doc repository
- Logging
- Query svcs

Network

Runtime Services
OBI: Open Buying on the Internet

Buyer organization

Requisitioner

Web Server

Validation

Approval Process

OBI Server

Seller organization

Merchant Server

OBI Server

TPA

Payment Process (SET)

Fulfillment Process

5

6

7

8

9

1

2

3

4

Buyer organization

Requisitioner

Web Server

Validation

Approval Process

OBI Server

Seller organization

Merchant Server

OBI Server

TPA

Payment Process (SET)

Fulfillment Process

5

6

7

8

9

1

2

3

4
Automation of TPA Life Cycle (Futures)

Discovery/Negotiation based on TPA templates

- Partner profile based on TPA template
  - Standard parameters, defaults, choices
- Services advertisement and discovery
  - Repository of partner profiles, query capability
  - Negotiation services
- Negotiation of TPA details between partners
- Register negotiated TPA at partner sites
- Do business
Summary

- Executable TPA (XML document)
  - Authoring tool, code generation tool
- TPA can support existing standards (e.g. OBI)
- TPA functions
  - B to B protocol (action definitions)
  - Document exchange definitions
  - Transport definitions
- Infrastructure for coordinating inter-business and intra-business processes (BPF)
Backup Foils

The following charts are preserved here for possible later use.
"Business-to-business e-commerce is expected to grow rapidly, at five to ten times the rate of business-to-consumer e-commerce."

IBM's Corporate Strategy Global Market Trend (GMT), 1998
B2B Before Computers

- Two companies decide to do business together.
- Lawyers draw up a paper trading-partner agreement defining roles, responsibilities, etc.
- Transactions initially exchanged paper documents.
- Computers then made these transactions faster and easier.
  - Origin of EDI
Electronic Data Exchange (EDI)

- Early worldwide e-commerce standard (ca. 1980)
  - ANSI X12 and UN/CEFACT
- Goal: Reduce paperwork, better efficiency thru e-commerce
- In use by some of the larger companies in developed nations
- Some problems: expensive, time-consuming to develop, not designed for the web model
- Follow-on work: ebXML
  - Reduce barriers of entry, simplify e-commerce for small companies / developing nations
  - XML based
So What is B2B e-Commerce?

- Buying and selling across the supply chain
  - Suppliers
  - Manufacturers
  - Distributors
  - Resellers
  - Buyers (businesses / consumers)

- Other ways of doing business electronically
  - Electronic Data Interchange (EDI)
  - Electronic bill presentment and payment
  - Electronic banking
  - Demand generation
Business to Business Integration Framework

Infrastructure for coordinating intra-business and inter-business processes in electronic commerce

- Supports B2B processes based on electronic Trading Partner Agreement (TPA) specified in XML
- OBI, RosettaNet and other emerging protocols supported as special cases
Using the Electronic TPA to do Business

- Parties agree on how to interact
- Write application code
- Write a TPA that expresses the agreement
- Generate TPA code at each partner's site
- Register (install) information from TPA
- Do business under the TPA
Standardizing the TPA

- Interoperability is essential to wide-spread B2B e-commerce
  - Avoid vendor-dependent solutions
  - Partners with different implementations must be able to do business

- Create a vendor-neutral standard TPA language

- IBM has submitted tpaML to ebXML as input to a standardization activity on electronic TPAs

- Draft tpaML specification available from http://xml.org/xmlorg-resources/b2bxml.shtml
Communication Example

<Communication>
  <Protocol>HTTP</Protocol>
  <HTTPNode>
    <OrgName>obibuyer</OrgName>
    <HTTPAddress><URL>https://x.com/OBIBuy</URL></HTTPAddress>
  </HTTPNode>
  <HTTPNode>
    <OrgName>obiseller</OrgName>
    <HTTPAddress><URL>https://y.com/obisell</URL></HTTPAddress>
  </HTTPNode>
  <TransportEncoding><encode/></TransportEncoding>
  <TransportTimeout>...</TransportTimeout>
  <NetworkDelay>...</NetworkDelay>
</Communication>
Document Exchange Example

<DocExchange>
  <MessageEncoding>BASE64</MessageEncoding>
  <MessageIdempotency>Yes</MessageIdempotency>
  <MessageRetries>
    <Retries>number</Retries>
    <RetryInterval>time</RetryInterval>
  </MessageRetries>
  <MessageSecurity>
    <!-- definitions for nonrepudiation or digital envelope -->
  </MessageSecurity>
</DocExchange>
Delivery Channel Example

<DeliveryChannelSet>

<!--one or more DeliveryChannel tags-->>
<DeliveryChannel

    ChannelId="channel01"
    TransportId="transport01"
    DocExchangeId="docexchange01" >

    <Version>version</Version>

</DeliveryChannel>

</DeliveryChannelChannelSet>
Key Security Elements

- **Transport Security**
  - Encryption Protocol
  - Authentication
    - Certificate type and issuer

- **Message Security**
  - Nonrepudiation
    - Protocol, hash function
    - Encryption and signature algorithms
    - Certificate type and issuer

- Digital envelope
  - Encryption algorithm
  - Certificate type and issuer
Supporting Tools

- Authoring tool
  - Understands TPA semantics

- Code generator
  - Converts TPA to code at each party's system
Customization/Generation Goals

- Create TPA object at each business partner.
  - Interface between TPA-defined actions and code at each party
- Automatic registration of TPA at each party
  - Parameters of party identification, communications, security, and business protocol
- Application can be up and running within minutes of finalizing TPA.

Future: automated TPA negotiation
- Dynamically build, execute, and terminate a relationship
Authoring Tool

Creating A Model

Authoring Tool → Existing Model → New Model → Imported Model → Exported Model → Authoring Tool

Creating A TPA

Authoring Tool → New Model → Authoring Tool → TPA DTD → TPA Document

Robert Kearney
Authoring Tool

- DTD defines only XML syntax
- Authoring tool understands TPA semantics
- Model of each tag
  - Data characteristics, defaults, rules
- DTD + collection of models + author input --> final TPA
Code Customization/Generation

Approaches to creating TPA-specific run-time code

- Customize generic code that represents TPA
- Generate specific class files for each TPA from templates
Code Customization

- Registration tool generates TPA Instance object
  - All the characteristics of each action
  - All other run-time parameters from TPA
- Generic TPA object is customized by contents of TPA Instance object at run time
- Other objects, such as document exchange also use TPA Instance object
Code Generation

Information File

Template

Macro Processor

TPA Document
Registration Information
Other Sources

Output

Robert Kearney
Code Generation Tool

- Generates TPA object
  - Interface between contract actions and methods at each party
- Tool fills in code templates (e.g. Java statements)
  - Macro language defines transformation of TPA
- Information file
  - Directories
  - Data types and their Java classes
  - References to other templates
- Template + TPA + Info file --> output class
General B2B Process Flow

Application Classes
- Portal, Web-page integration
- Catalog integration
- B2B processes
  - Ordering, fulfillment, payment, etc.
- Supply chain
  - e.g. insurors, brokers, reinsurers
BPF Components and Flow

Trading Partner Agreement

Automatic Generation of Interface/Rule Code

Inbound Client requests/replies

Outbound Sub-contracted Service requests/replies

Local business processes

ERP, Workflow and other Applications

BPF Manager

TPA object

I/F to Bus.
Logic
- Methods
- Rules

Application Admin.

Resource Mgmt.

Rule Engine

Error Control

BPF Services

BPF Log

Event Handling

Group Compensation

Conversation history

Query status/history

Audit Trail

Audit Trail

Operating Systems: NT OS/400 AIX Solaris OS/390

Transport security

Msg adapters

Transport security

Msg adapters

Operating Systems: NT OS/400 AIX Solaris OS/390

ERP, Workflow and other Applications

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Audit Trail

Auditory Trail
tpaML and OpenEDI

BOV=Business Operational View
FSV=Functional Services View
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