Introduction to The Versatile B2B Gateway

(An SOA Design Pattern)

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Introduction

B2B exchanges as supported between pairs of business partners will require diverse modes of connectivity as well as different forms of back-end integration.

- Some messages will invoke Web services that are deployed behind the firewall, some will not.
- Some deployments will be strongly restricted in terms of access and security, others will not.
- Some endpoints will be up 24/7, some will not.

A gateway solution that recognizes the need for different styles of connectivity, as well as of back-end integrations, is desirable. Such a solution must also build on widely accepted protocols (SOAP, HTTP), in order to be adopted by a broad spectrum of users.

The solution introduced here under the name of "Versatile B2B Gateway" is designed to address these requirements. It can be seen as a way to extend a service-oriented architecture with a B2B connectivity solution.

B2B Integration: Supporting Various Patterns of Message Consumption

B2B exchanges can be of very diverse nature and supporting this diversity is likely to require a combination of technology packages that otherwise would be self-sufficient for some type of exchange. Some B2B exchanges are akin to service invocations, and some are not.

When a Message is a Service Invocation:

The notion of external message as a service invocation is appropriate in the following cases:

- The immediate consumer of the message is a status inquiry service that is able to query back-end systems running behind the firewall, while managing an interactive user session. A service is justified here to manage state about this user interaction, and act as intelligent mediator to back-end resources.
- The message is intended to leverage a computational resource or service remotely available on a public or private Web site. The message is often generated automatically by an application or business process, or another Web service, as a way to delegate some part of the processing.
- The message carries form data (subscription, status info, etc) from a user, and the processing service is expected to provide a quick feedback to the user in terms of whether this form is valid, accepted or invalid, before submitting the form to a back-end process or service.

These use cases are well supported by common Web services stacks, although a B2B gateway may provide additional support on the connectivity side, as described later.

When a Message is *Not* a Service Invocation:

Messages may carry business documents that exist and persist independently from the way these are processed. The processing of such messages often follows an “event” model, instead of a service invocation model. The processing of the enveloped business document is not pre-determined, and may depend on the context (i.e. Other events, or some processing state) to define which service should consume it – if it is ever intended to a service. In addition, some pre-processing may be required, that is orthogonal to the nature of the enclosed business document. Such cases include the following:

- The immediate message consumer - after message reception - is a business process instance (as supported by BPM engines) that needs this document at some point in its life cycle. In other words, instead of having a document determining which service to invoke, we have an existing business process deciding which document to pick-up. The selection of the business document to be processed may not be tied to the structure of this document (e.g. XML schema). The decision whether the document is valid or not is a semantic concern controlled by the process and not by the middleware. A publish-subscribe model is more appropriate here, combined with filtering that may involve both message header and payload data. This business process may later decide if a service must be invoked, and which one.

- The messages intended to an application component that does not require real-time processing, are batched for processing at a more convenient time of the day. The immediate consumer of such messages will not be an application service, but again a subscriber that may perform filtering based on both structure and semantic content before adding to the batch intended for this application.
- The immediate message consumer is a dispatching component that forwards internally the received documents based on some content analysis (header or payload).

Although the immediate message consumer in above cases could be wrapped as a service (e.g. As defined in WSDL), there is little or no value in doing so. The above use cases typically involve a B2B gateway and / or an integration broker. The actual service invocation – with application semantics – would only occur later in the process and will originate locally on receiver side, not on the partner initiative.

Manageability Considerations:

The description of these business documents (schemas) in WSDL is not without impact on manageability. In some large supply-chains, partners must frequently handle hundreds of different types of documents - and not uncommonly thousands. This is because customization of document types is the rule and not the exception even with strongly coercive standards such as RosettaNet.

As mentioned before, these business documents may or may not be directly associated with service invocation in a predefined way. If they are, their type definitions (e.g. XML schemas) will typically be referred to in WSDL files. Because the pool of document types that are to be handled is often evolving (additions, removals, versioning, customization), the set of related WSDL files is intrinsically unstable. It is imperative to reduce the impact of this instability on business partners, and also to make it more manageable, because these changes in service definitions usually cascade down to new code generation and client proxy generation.

By introducing a gateway component that shields partners from these upgrades, messages do not have to be turned down because the contained business document does not comply with the latest service upgrade. Instead, data transformation, document mappings, alternate routing – all functions ultimately supported by an ESB, but also by a more conventional integration broker – may take place after message reception and before the destination service is invoked. This allows for smooth, controlled transitions and upgrades among many non-synchronized business partners.

Heterogeneous B2B Exchanges:

As previously explained, B2B exchanges may have quite different profiles in terms of their nature, the stability of their content, the context in which they operate, the back-end connection they use, the way messages are processed. This heterogeneity in the message handling will persist even when adopting a single standard for messages or documents.

As a consequence, the service invocation model, as currently implemented in WS stacks, has value for some exchanges and less for others. When it has value, its scalability and manageability still depends on the appropriate architecture.

Supporting Several Modes of Connectivity

The term "connectivity" denotes here the type and style of a B2B connection between two partners. We have seen previously that some exchanges will be service-centered, others will be document-centered (in the sense that an RPC-style messaging is not the most appropriate for processing these documents). In addition, different connectivity restrictions may require that some business partners only pull messages they receive, while others can receive messages pushed to them via requests. Such modes of message transfer should remain orthogonal to the service definition. The notion of WSDL binding may capture only some aspects of these connectivity patterns, but in a way that ties these to the service definition.

An enterprise gateway must also accommodate various business partners, in particular SMBs. Depending on their profile, trading partners may experience intermittent connectivity, restricted addressing due to the use of ISPs and/or firewalls, different processing flow capabilities, reduced hand-shake capability and no out-of-band visibility. These requirements are addressed by ebMS V3.

Outline of the Versatile B2B Gateway

The versatile B2B gateway has the following general features:

- It is able to directly bind to various message consumption models behind the firewall: queuing, service, application callback, enterprise bus.
- It provides a loose, asynchronous coupling with business partners, by relying on ebXML messaging (ebMS) (OASIS / ISO 15000-2). The association message-service, if it exists, may be controlled by the receiver side, vs. hard-coded within the message.
- In its advanced version based on ebMS V3, the gateway leverages protocol-level

Web services standards (WS-Security, WS-Addressing, WS-Reliability / WS-ReliableMessaging) and is compatible with key WS-I profiles such as SSP 1.0, AP 1.0) so that compliant WS stacks and SOAP processors can be used.

- Also relying on ebMS V3, an advanced version of the versatile gateway will address the diversity of connectivity styles that is found between business partners, and also within a single enterprise.

Figure 1 illustrates the various ways the B2B gateway may connect to enterprise middleware and applications.

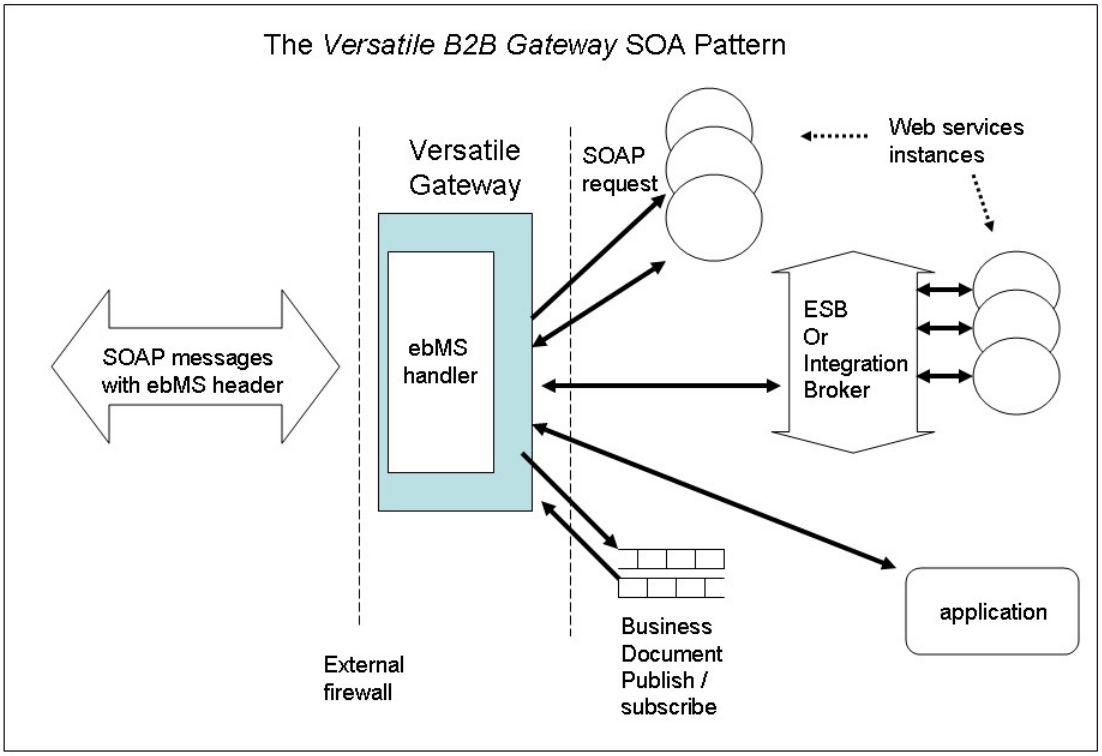
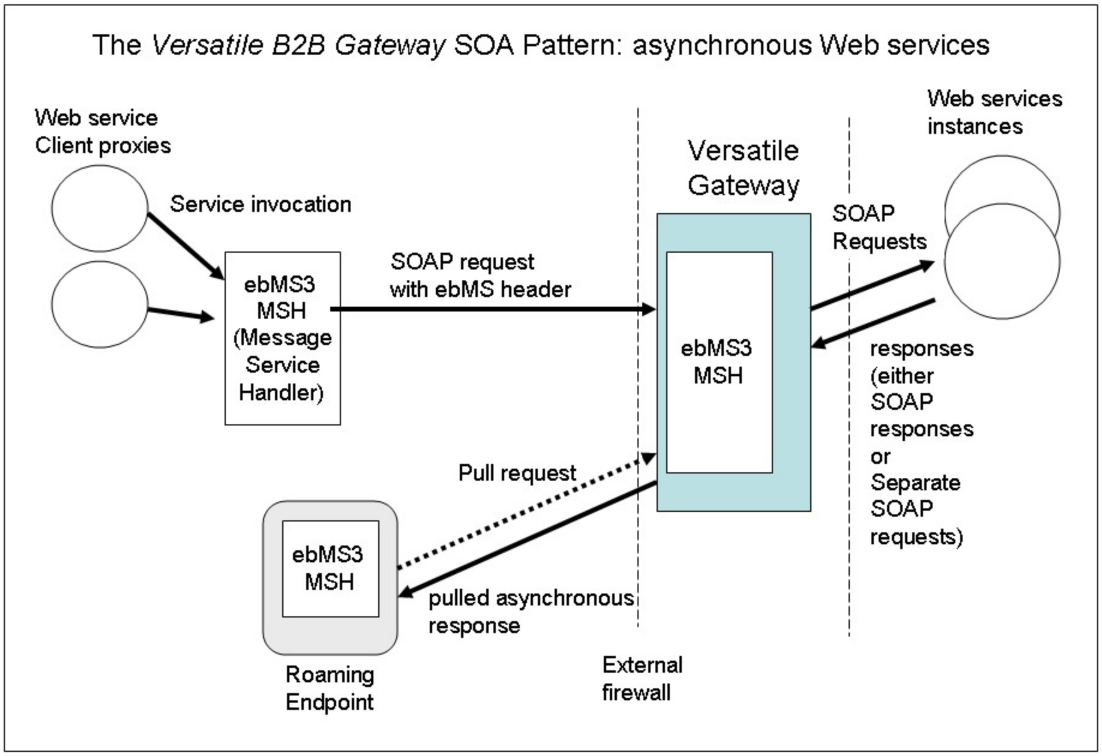

The *Versatile B2B Gateway* SOA Pattern
Versatile Gateway
SOAP request
Web services instances
SOAP messages with ebMS header
ebMS handler
ESB Or Integration Broker
application
Business Document Publish / subscribe
External firewall

Figure 1. Overview of Integration Options in the Versatile B2B Gateway.

The gateway may interface with other middleware (either integration broker or MOM: TIBCO Rendezvous, WebSphere MQ, JMS, MSMQ, etc.), or directly with a back-end application. The gateway acts as a typical proxy: the sender of the message only uses the gateway URL. The actual physical address of the final destination (e.g. a Web service deployed behind the firewall) does not have to be known from the external client. The service or application may be redeployed on another internal server without affecting the client code: only the routing function in the gateway is affected.

In its version based on ebMS V3, the gateway interaction with back-end Web services as defined by WSDL, may follow a typical SOAP intermediary model without extra code to be written: when receiving a message that was initially generated as a Web service invocation, the ebMS MSH strips this message of its ebMS-related header (the only role of which has been to support advanced messaging functions on the B2B side), reverting the message into a Web service invocation that is properly routed by using addressing capabilities as provided by WS-Addressing.

Figure 2 illustrates the use case where the B2B gateway must allow business partners with diverse connectivity capabilities, to cooperate. The message consumption model on the back-end is restricted here of a Web service. This case assumes here the use of ebMS V3, although ebMS V2 (OASIS / ISO 15000-2) may be used with additional coding in the gateway. A roaming endpoint with no fixed IP address is expecting an asynchronous response from a Web service previously invoked by another partner. Not being able to receive incoming requests, it will pull the response from the gateway. The Web service on the back-end is not aware of the way this response will reach its destination: it has issued the response as a separate protocol request to the gateway, which in turn may push this response or get it pulled by the destination party. The proper mode of transfer of the response is decided by the gateway, based on configuration and routing data. When using ebMS V3, the content of WS-Addressing headers and their association with a pre-configured transfer modes is sufficient for the gateway to do this.

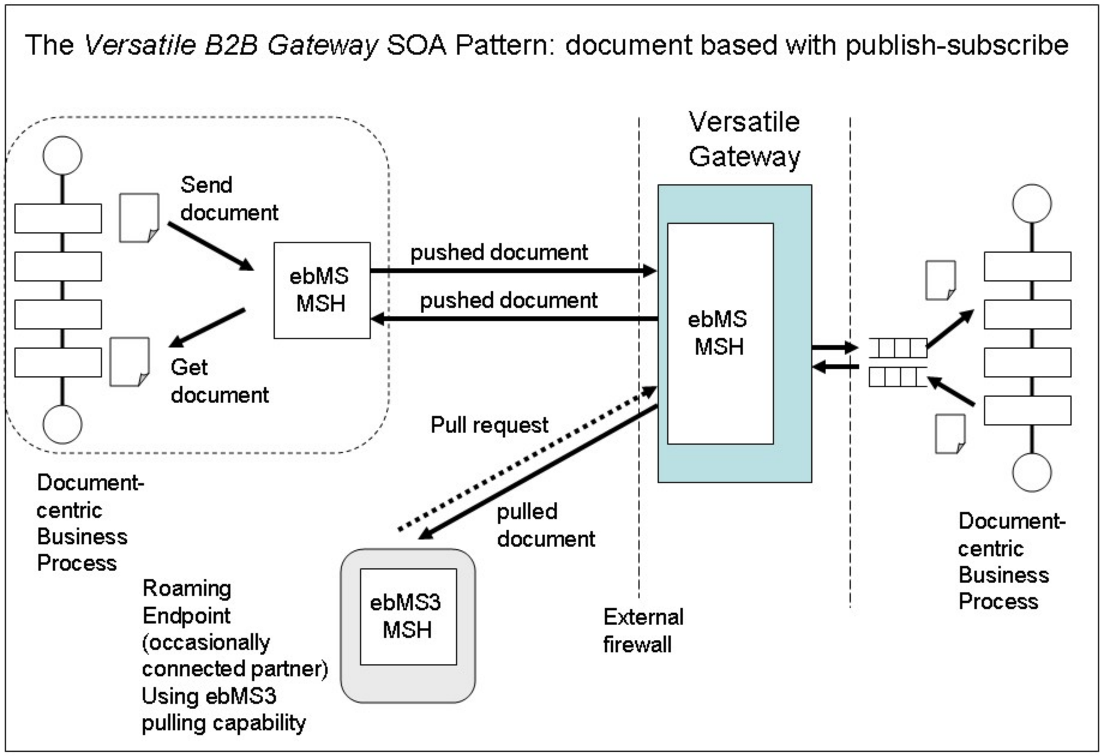

The *Versatile B2B Gateway* SOA Pattern: asynchronous Web services

Web service Client proxies
Service invocation
ebMS3 MSH (Message Service Handler)
SOAP request with ebMS header
Versatile Gateway
ebMS3 MSH
SOAP Requests
Web services instances
responses (either SOAP responses or Separate SOAP requests)
Pull request
pulled asynchronous response
ebMS3 MSH
Roaming Endpoint
External firewall

Figure 2. An Asynchronous Web Service Use Case.

In a variant of the previous case, the message exchange is now supported by a Web service Request-response operation. In such cases, most Web services stacks running over HTTP assume that the response is always intended to the requester, and that the exchange is short enough so that the latter is connected at the time the response is sent back. Both assumptions are incorrect in our example, because the response is intended for another endpoint that is not always connected. The versatile gateway still allows the Web service instance to keep responding synchronously on the same connection to the same proxy-requester - here the gateway.

Figure 3 below illustrates the use case where the same B2B gateway must allow partners to exchange business documents of diverse types, using a publish-subscribe model to integrate with back-end business processes. The documents may be XML or not. When they are of XML format, they may comply with a large number of different schemas or DTDs. The posting to the back-end queue is decided based on ebMS header information, as opposed to WS-Addressing headers as in the previous case. In turn, business documents made available to the gateway may be accessed from outside, either in a pushing mode or in a pulling mode of transfer if ebMS V3 is used, depending on the capability and constraints of the destination.



The *Versatile B2B Gateway* SOA Pattern: document based with publish-subscribe

Send document
ebMS MSH
Get document
pushed document
pushed document
Versatile Gateway
ebMS MSH
Pull request
pulled document
Document-centric Business Process
Roaming Endpoint (occasionally connected partner) Using ebMS3 pulling capability
ebMS3 MSH
External firewall
Document-centric Business Process

Figure 3. Posting and Fetching Business Documents.

Figure 4 below illustrates the use case where some message transfer mode may be possible with a business partner (here hosting Web service A) but not with another (here hosting Web service B), due to different security constraints. The back-end message consumption is again illustrated here as a Web service, not exclusive of other alternatives. The diversity in transfer modes is here supported by using ebMS V3. In the example below, the partner hosting service B will not allow for external incoming requests, or will allow it only from a very limited number of partners. In such a case, it is desirable to keep the client code and also the Web service definition independent from such constraints. The security environment may vary over time for A and for B and the client application should not be affected, remaining unaware of whether its requests are pushed or pulled toward the destination service.

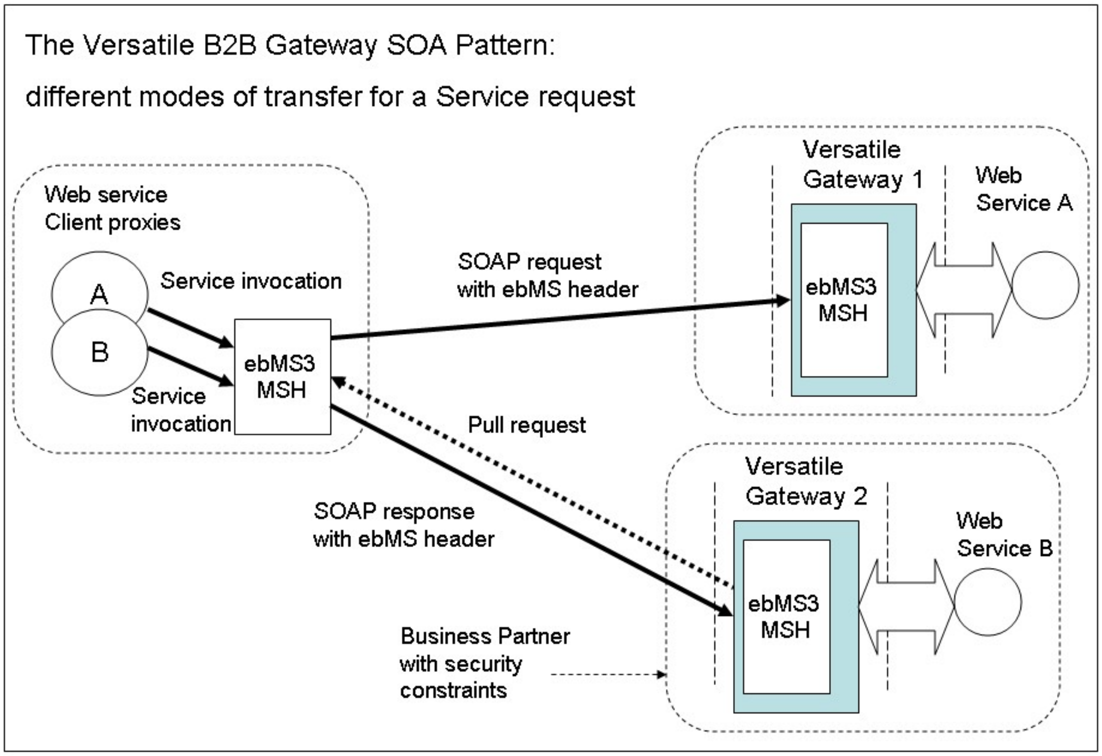

The Versatile B2B Gateway SOA Pattern:
different modes of transfer for a Service request
Web service Client proxies
A
B
Service invocation
Service invocation
ebMS3 MSH
SOAP request with ebMS header
Versatile Gateway 1
Web Service A
ebMS3 MSH
Pull request
SOAP response with ebMS header
Versatile Gateway 2
Web Service B
ebMS3 MSH
Business Partner with security constraints

Figure 4. Pushing or Pulling a Service Request.

The mode of tansfer above is decided based on an agreement shared between the two ebMS endpoints. This agreement may vary over time without affecting the service and client code.

As a summary, the versatile B2B gateway introduced here from a user perspective is an SOA design pattern characterized as follows:

- On the external side, it supports messaging functions such as those found in ebMS and in particular ebMS V3 which address connectivity constraints previously mentioned, along with built-in support for monitoring the compliance of exchanges to business transactions.
- On the internal side, it allows for several integration solutions:
    - The Web service intermediary model where the receiving (ebMS) message handler, as a common endpoint and SOAP intermediary, is internally dispatching messages after stripping them from ebMS-related message headers to one or more WS deployed behind the firewall,
    - The broker feeder model, where the immediate message consumer is an ESB or integration broker, that will mediate the Web service invocation.
    - The message queue model, where the receiving message handler is posting the received documents to a queue for internal consumption, or subscribing to a queue for messages to be sent out.
    - Direct ad-hoc communication with an application, e.g. using a callback "onMessage" type of function.
- It supports message forwarding depending on the back-end consumption mode based on ebMS headers, and additionall on WS-Addressing headers when using ebMS V3.

A more detailed specification of the versatile B2B gateway will the the object of a separate document.

The Versatile B2B Gateway as an SOA Design Pattern

The term "SOA Design Pattern" denotes here a design pattern that addresses a specific SOA function in a way that leverages existing Web services and e-Business standards. Such patterns only pretend at providing one solution among several alternatives.

An SOA Design Pattern is not a specification profile, although it may include some elements of profiling for underlying specifications. Instead, an SOA Design Pattern refers to supporting specification profiles when these exist, and may be compatible with several of these profiles.

The "Versatile B2B Gateway" is an SOA design pattern for B2B integration. It supports a well-established principle in SOA: loosely coupled interactions, where the messaging function is carried out independently from the service interface logic, and is not narrowly associated with a service invocation even if ultimately its processing will result in some service(s) invocation(s). In this model, the B2B gateway acts as an eBusiness extension to an Enterprise Service Bus (ESB) or to a more conventional substitute of it (e.g. an integration broker). However, the gateway solution presented here also allows a tight coupling between message and service, when appropriate – hence the name "versatile gateway". In this usage, the B2B gateway behaves as a SOAP intermediary (in the sense given in SOAP 1.1 specification). This intermediary has its own address, and acts as a proxy to the ultimate WS endpoints.

Other SOA functional areas that may be subject to other SOA design patterns are:

- business transaction monitoring,
- repository access and profiling,
- service orchestration,
- agreements and policies management,