Enabling Chemical Industry Business Collaborations with Web Services

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Executive Summary

Definition

A Web Service is a software system designed to support interoperable machine-to-machine interaction over a network.

Problem

Web Services have been hyped for years and it is clear that the hype is turning into reality as standards mature and solution providers implement support for them. Still, there are myriad standards (and versions of each) in various states of maturity and vendor support. While each company could study the Web Services landscape independently and identify a path forward, an industry effort might provide useful input into that process while also revealing opportunities to drive industry-standard approaches to Web Services implementations.

Current State of Web Services

The Web Services-related standards relevant to business-to-business (B2B) processes are identified and described; and their current state and direction are noted in the paper. In summary, key outstanding Web Services standards are finally maturing to the point where they can be incorporated into profiles, along with other Web Services standards, to solve business problems.

Opportunities

CIDX members have consistently expressed three objectives:

1. to increase the number of electronically enabled collaborations
2. to increase the number of electronically enabled partners
3. to achieve previous objectives within the chemical industry, and between the chemical industry and other industries

Web Services-based solutions are a promising approach to achieving these objectives.

Recommendations

- CIDX should executing a project to:
  - Investigate current chemical-industry Web Services implementations and document lessons learned
  - Identify candidate Web Services to be piloted in support of existing CIDX processes—preferably a small project applicable to a large user base that uses current message standards.
  - Identify candidate Web Services to be piloted in support of a new process within the chemical industry.
  - Conduct each pilot and report results to the CIDX Steering Committee.
CIDX should monitor and consider participating in WS-I projects.

Recommend not participating in W3C or OASIS Web Services-related projects (although attending an occasional forum may be appropriate).

Recommend closely monitoring Web Services-standards maturation processes.
Web Services

Introduction

Web Services is a technology-industry term for a broad set of standards that have the potential to become the preferred method for transporting data and executing processes between loosely-coupled applications. As CIDX considers potential replacement technology for its RNIF-based Transport Routing and Packaging layer, Web Services represents a candidate technology. Key chemical-industry software providers are playing major roles in Web Services standards development and are marketing products based on Web Services architectures. The impact on the chemical industry will be significant.

Objectives

This paper’s objectives are to:

- Define Web Services for the purpose of discussion within CIDX. Identify a Web Services reference model or stack that can be used for further discussion in CIDX and with key CIDX partners.
- Identify pertinent Web Services standard stack components, their potential for use within CIDX and a current assessment of their maturity
- Provide use cases for how CIDX messages and business process guidelines might be implemented in a Web Services framework.
- Identify the value of CIDX and/or CIDX member company participation in Web Services standard activities in OASIS and other Web Services standards organizations
- Explore the value of CIDX membership in the Web Services Interoperability (WS-I) organization and the value to CIDX membership of defining WS-I profiles based on CIDX business process guidelines and messages.
- Develop a recommendation for timing and appropriateness of CIDX adoption of Web Services standards (May be more appropriate as a follow-on project.)
- Document CIDX member company early adopter experiences with Web Services implementations.

Web Services Overview

Web Services Definition

For the purpose of discussion within CIDX, CIDX will use the Wikipedia Web Services definition:

The W3C defines a Web Service as a software system designed to support interoperable machine-to-machine interaction over a network.

Because this definition encompasses many different systems, in common usage the term usually refers to those services that use SOAP-formatted XML envelopes and have their interfaces
described by WSDL. For example, WS-I only recognizes Web Services in the context of these specifications.¹

It important to note that there are myriad definitions. Even among W3C documents one can find multiple definitions.

**Web Services Stack**

The following table lists the main Web Services standards relevant to CIDX. Other Web Services standards exist, but they are not so relevant for B2B integration.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
<th>Status (as of 2006-11-12)</th>
<th>Maintained by</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foundational</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOAP</td>
<td>Basic messaging specification</td>
<td>Stable SOAP 1.1 and 1.2 widely implemented</td>
<td>W3C</td>
</tr>
<tr>
<td>WSDL</td>
<td>Basic description language for a WS</td>
<td>Stable WSDL 1.1 widely implemented WSDL 2.0 not widely implemented</td>
<td>W3C</td>
</tr>
<tr>
<td>UDDI</td>
<td>Specifies access to WS registries</td>
<td>Stable version 2.0 and 3.0 implemented mainly within enterprises</td>
<td>OASIS</td>
</tr>
<tr>
<td><strong>Messaging</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-I Basic Profile</td>
<td>First WS-I profile on how to use SOAP, WSDL and UDDI together</td>
<td>Stable, but being updated to support SOAP 1.2 and WS-Addressing</td>
<td>WS-I</td>
</tr>
<tr>
<td>WS-Reliable Messaging</td>
<td>Ensures reliable delivery of a message</td>
<td>Public review</td>
<td>OASIS</td>
</tr>
<tr>
<td>WS-Addressing</td>
<td>Contains metadata in a message instance that can be used for routing</td>
<td>Stable</td>
<td>W3C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
<th>Status</th>
<th>Maintained by</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Security</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-Security</td>
<td>Basic specification for digitally signing and encrypting SOAP messages</td>
<td>Stable</td>
<td>OASIS</td>
</tr>
<tr>
<td>WS-Secure Conversation</td>
<td>Specification that allows the establishment of secure sessions in order to, for example, avoid the need for re-authentication for single messages sent in a conversation</td>
<td>Not yet submitted to a standards organization</td>
<td>Nobody, yet (draft specification states copyright by RSA, IBM, Microsoft, et. al.)</td>
</tr>
<tr>
<td>WS-Trust</td>
<td>Specification that allows the exchange of security tokens</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-I Basic Security Profile</td>
<td>WS-I profile on how to use WS -security to secure SOAP messages</td>
<td>99% complete</td>
<td>WS-I</td>
</tr>
<tr>
<td>WS-I Reliable Secure Profile</td>
<td>WS-I Profile that will cover WS Security, WS-Reliable Messaging, WS Addressing and other specifications. This will be critical to B2B integration.</td>
<td>Just started work Completion expected in 2007</td>
<td>WS-I</td>
</tr>
<tr>
<td><strong>Process Definition</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-BPEL</td>
<td>Orchestration language that defines how to combine Web Services to create a composite process</td>
<td>WS-BPEL 2.0 now in public review</td>
<td>OASIS</td>
</tr>
<tr>
<td><strong>Policy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-Policy</td>
<td>Language that allows constraints to be placed on a WS e.g., policies on how to secure a message using WS-Security or send a message reliably using WS-Reliable Messaging</td>
<td>Under development</td>
<td>W3C</td>
</tr>
</tbody>
</table>
### Opportunities That Web Services May Present

CIDX members have consistently expressed three objectives:

1. to increase the percentage of electronically enabled collaborations
2. to increase the percentage of electronically enabled partners
3. to achieve previous objectives within the chemical industry, and between the chemical industry and other industries

CIDX currently specifies RNIF 1.1 as the preferred message transport protocol supporting Chem eStandards message exchanges. RNIF 1.1 is becoming increasingly expensive to maintain and is frequently identified as a hurdle in potential Chem eStandards implementation evaluations—particularly in cases where the potential implementation involves a party outside the chemical industry or involves a small-or-medium-sized enterprise (SME). Web Services may address this issue and help CIDX members achieve their objectives.

### Reduce Cost

Solution providers have demonstrated a clear commitment to implementing Web Services-based solutions. Assuming that those solutions are standards-based, one can expect certain fundamental solution-component costs—such as message-service costs—to drop as such components become increasingly standardized and commoditized.

### Enable Interoperability, Including Cross-Industry

There is no indication that industry-specific Web Services-based standards or implementations will emerge. Furthermore, other than the use AS2 for retail, there doesn’t
Web Services

appear to be any B2B-suitable alternative to Web Services being developed. Given the intentional non-industry-specific nature of Web Services and it’s likely continued support by solution providers, CIDX can expect that Web Services-based solutions will address the issue of cross-industry interoperability.

Enable Small-to-Medium-Sized Enterprises (SME)

Enabling chemical-industry SMEs has been a recent CIDX objective. SMEs require inexpensive and straightforward solutions for message transport and integration—solutions yet to be identified. As suggested in the previous two sections, Web Services promises to address the cost and complexity of the message transport requirements through the use of standard and commoditized messaging servers.

Web Services in Action

Company Implementations

**Bayer Business Services: Customer Interaction Center (CIC) Integrated Customer View for Improved Service.**

Bayer’s CIC Integrated Customer View uses both EAI and a growing number of Web Services to provide information to customers and partners. The CIC delivers a comprehensive view of a partner’s activity, which draws data from numerous backend systems and sources. Order status, Pricing, Invoicing, Consignment information and Customer Complaint tracking are collected and organized to provide the CSR with an optimal view of the key data points in the Customer Service process.

**Rhodia Inc.: Price and Availability Web Service.**

Developed in conjunction with an Integration server, this service accepts calls from an authorized requestor and creates a Price and Availability request into an ERP system, and responds with the current price and quantity on-hand. It can respond to requests both inside and external to the company firewall.

Standards Bodies

**OTA (Open Travel Alliance): Travel Industry Web Service Interoperability Standards**

OTA is a Travel Industry organization dedicated to improving efficiency and connectivity among travel industry members through the use of internet technology. OTA’s original goals as stated in 2001 were:

- Openness
- Flexibility
- Platform Independence
- Security
Extensibility
International scope

Additional goals were recently added, including:

- Interoperability
- Simplicity
- Optimal performance
- Ready acceptance.

OTA developed a series of recommended guidelines employing recognized standards such as SOAP, HTTP and WDSL during 2005-2006. The OTA Architecture sub-committee has released three documents that provide direction in line with recommendations from the W3C (WS-I Basic profile, WS-I Security Specification, XML-Signature and XML-Encryption specs, along with SOAP 1.1/1.2)

**RAPID: Web Services White Paper**

RAPID is a non-profit eBusiness standards organization serving the agriculture industry. Some RAPID members expressed a need to enable simple lookup-type functionality without the overhead of transaction-supported messaging. RAPID launched a project team to explore potential solutions and as a result produced a white paper providing guidance for addressing the issue through Web Services use.

**RosettaNet: Multiple Messaging Services Project**

RosettaNet serves the electronics industry and its members were early adopters of eBusiness. RosettaNet’s members very early recognized the need for a feature-rich message-service specification and as a result RosettaNet developed their RosettaNet Implementation Framework (RNIF). RNIF has been a success (CIDX still specifies use of RNIF 1.1) but as the architectural experts in RosettaNet examined the long-term direction of message-service solutions, they concluded that Web Services would mature to meet message-service needs of not only the electronic industry, but all industries. As a result RosettaNet decided to not continue to update RNIF and instead turn their attention to develop tools and guidance that would help their members and their members’ trading partners to transition to Web Services in as seamless process as possible. They accomplished this through a project called Multiple Messaging Services (MMS).

**Potential Pilot Opportunities**

**Order Status**

Some of the most time-consuming activities related to order processing are those related to determining and communicating the current status of a customer’s order. In the majority of cases today, order status is obtained through phone calls directly to a customer service representative who must, in most cases, stop their current activities and respond to the
customer’s inquiry. The Customer Service Rep would most likely access information stored on their host systems and convey the status to the customer verbally.

**Order Status – Synchronous**

Obviously, a better, more efficient approach would be to provide real-time responses to customer queries without the intervention of a CSR. Electronic queries, carrying customer and order information, could electronically interrogate a host system and return a response in near-real time; certainly as quickly as a CSR might be able to key in the same query into their system and receive a response.

**Order status – Asynchronous**

At times, order queries are more complex or require some additional manipulation. In this scenario, the requestor would send a status request to the host system and receive an immediate response that the request was received. The host system would process the request, post and store the result, awaiting a Result Request from the originator.

Periodically, this stored data may be updated to reflect current conditions. The request originator can then transmit another Result Request and poll the site for updated information as frequently as they wish.

**Enable VMI (VMOI) capability at distributor locations**

Many Manufacturing companies deal with independent distribution companies who buy and then sell the products at a profit. Many of the Distributors have legacy or different processing systems than the manufacturing companies, and Inventory management (under a VMI/VOMI) model becomes problematic. Due to the diversity of systems used among the distributors, it is difficult to standardize upon a method of capturing and processing inventory levels of product on a regular basis.

If enabled, the manufacturing company may offer to provide a web interface to permit the entry of inventory levels by the distributor. The Manufacturers may also offer to develop and install a component on the Distributor system to capture the relevant inventory data as reported in their legacy applications, and forward a standard IAU transaction to the manufacturing party.

**Conclusions & Recommendations**

- Conclude that Web Services will enable current processes to be extended to other industries and to SMEs.
- Conclude that Web Services will enable greater eBusiness penetration throughout the supply chain, both inside and outside the chemical industry.
- Recommend executing a project to:
  - Investigate current chemical-industry Web Services implementations and document lessons learned
Web Services

- Identify candidate Web Services to be piloted in support of existing CIDX processes – preferably a small project applicable to a large user base that employs current message standards.
- Identify candidate Web Services to be piloted in support of a new process within the chemical industry.
- Conduct each pilot and report results to the CIDX Steering Committee.
- Recommend monitoring and consider participating in WS-I projects.
- Recommend not participating in W3C or OASIS Web Services-related projects (although attending an occasional forum would be appropriate if doing so supports other recommendations).
- Conclude that while Web Services are in production supporting narrowly defined functions, Web Services are not quite ready for wide scale system-to-system messaging implementation.
- Conclude that the standards being developed by WS-I and other SDOs are maturing (refer to the Web Services Stack section), and that a complete standards suite will not be ready until 2007/2008. This preliminary pilot would allow CIDX to test Web Services concepts, their impact upon segments of our business, and the effect upon business processes currently being developed and refined.
- Recommend closely monitoring Web Services-standards maturation processes.
Appendix A: Technical Advancements

Web Services exposes functions and services otherwise held internally to external users and partners. However, to be widely adopted, Web Services rely upon standards being developed and refined by the W3C and its working groups. These standards, under the general heading of WS-I (Web Services-Interoperability) define the way Web Services will interact, exchange information and protect the information they process. General guidelines and standards have already been developed for WS Reliable Messaging, and WS-Security and will be used as a foundation for subsequent Web Services projects initiated by CIDX.

With Existing Messages

Defined business processes can be upgraded or enhanced with the insertion of Web Services components in key activities that might otherwise require manual intervention and processing delays on the part of SME trading partners. Those processes and messages are identified in Section 2.7 Message Categorization.

With New Messages and Structure

New business processes, either evolving due to technology changes, or heretofore impossible to accomplish with existing message structures, can be addressed with the use of Web Services. Examples of such messages are

- Restricted Partner Shipments
- Sales Tax Computation
- RFID Tracking
- Document Query and retrieval

The exchange of information between trading partners using different applications and industry contexts requires non-established structures of data to request and deliver information. This could be accomplished by Core Components which is being examined in a parallel CIDX framing project.

Appendix B: Message Categorization

The current CIDX processes and related messages can be categorized into two general types; Asynchronous and Synchronous. Those activities that take place in real-time (requests for information, status or other information demanding an immediate response) are Synchronous. These activities usually involve specific requests that require minimal amounts of information to be passed between partners, but the information is deemed ‘time-critical’.

Those which do not demand an immediate response or action (but which may provide one at a later time) are viewed as Asynchronous. These transactions are usually more complex, carry a large amount of information, and are not viewed as ‘time-critical’ within the scope of the accepted business process.
<table>
<thead>
<tr>
<th>Message</th>
<th>Type</th>
<th>In Use</th>
<th>Process</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>OrderCreate</td>
<td>Asynch + Synch</td>
<td>Yes</td>
<td>OTC</td>
<td>OTC is <em>Order-to-Cash</em></td>
</tr>
<tr>
<td>OrderChange</td>
<td>Synch</td>
<td>Yes</td>
<td>OTC</td>
<td></td>
</tr>
<tr>
<td>Available to Promise</td>
<td>Synch</td>
<td>Yes</td>
<td>OTC</td>
<td>Permit controlled access to view product availability prior to purchase</td>
</tr>
<tr>
<td>OrderStatus</td>
<td>Synch (Ad-hoc-‘Pull’) and Asynch (periodic update – ‘Push’)</td>
<td>No</td>
<td>OTC</td>
<td>Permit controlled access to system information regarding process status of open orders (Diagram 2) \ Storage of reports for future use (Diagram 3)</td>
</tr>
<tr>
<td>OrderStatusUpdate</td>
<td>Asynch</td>
<td>No</td>
<td>OTC</td>
<td>(Diagram 4)</td>
</tr>
<tr>
<td>ShipmentStatus / Tracking</td>
<td>Synch</td>
<td>No</td>
<td>SC</td>
<td>Permit controlled access to specific information regarding status of product shipments</td>
</tr>
<tr>
<td>Sales Tax Computation</td>
<td>Synch</td>
<td>No</td>
<td>OTC</td>
<td>A Callable routine to compute applicable taxes and return value to requestor</td>
</tr>
<tr>
<td>Restricted Parties List</td>
<td>Synch</td>
<td>No</td>
<td>OTC</td>
<td>A callable routine to validate ship-to locations to ensure compliance with international laws</td>
</tr>
<tr>
<td>Document Query</td>
<td>Synch</td>
<td>No</td>
<td>PI</td>
<td>Publish links to documents required for order management (MSDS, COA, TDS )</td>
</tr>
<tr>
<td>Tank Measurement</td>
<td>Synch</td>
<td>No</td>
<td>SC</td>
<td>Publish measurement data to website for query by suppliers (VMI)</td>
</tr>
<tr>
<td>RFID Tracking</td>
<td>Synch</td>
<td>No</td>
<td>SC</td>
<td>Publish tracking data for product movements generated from Tags</td>
</tr>
<tr>
<td>Electronic Invoicing / Account Status</td>
<td>Synch</td>
<td>No</td>
<td>OTC</td>
<td>Permit customer to access current account information including copies of Invoices</td>
</tr>
</tbody>
</table>
## Web Services

<table>
<thead>
<tr>
<th>Message</th>
<th>Type</th>
<th>In Use</th>
<th>Process</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic Payment</td>
<td>ASYNCH</td>
<td>No</td>
<td>OTC</td>
<td>Allow customer to make electronic payments and apply cash to system</td>
</tr>
</tbody>
</table>

### Appendix C: Synchronous vs. Asynchronous Services

Services can be either synchronous or asynchronous at either the business or technology levels.

**Synchronous vs. Asynchronous Business Services**

The speed with which a business can respond to a request such as an Order Status Request will vary depending on the technology support that the business has available. For example if a business has “back-end” computer systems that are permanently online, then the business may be able to provide a business response within seconds.

On the other hand another business, particularly a smaller business, may have to resort to manual records to provide the same information in which case, the response time would be much slower, maybe minutes, hours or perhaps days if it is a weekend.

![Diagram 1](image)

In the first case the business service is synchronous since the response could be provided immediately whereas in the latter case it would have to asynchronous since the response would be delayed.

**Synchronous Web Services**

At the technology level, Web Services can used to carry the request and response. However the way HTTP is used will vary depending on whether or not the business service is synchronous or asynchronous.
For a synchronous business service where the response can be generated in seconds, a synchronous Web service may be used. In this case, a request message on an HTTP Post results in a response message sent on the HTTP Response as in the diagram 2 below.

In this example, Party A, the sender of the Order Status Request message, waits for the response from Party B to arrive. This “waiting for a response” is the distinguishing factor of a synchronous service.

**Asynchronous Web Services**

However if the business service is asynchronous, because a response cannot be generated immediately, then Party A can’t wait for a response from Party B as the HTTP Post would “time out” and fail. This means that the response message must be sent in another HTTP session that is separate from the original request. One way of doing this is as in diagram 3 below.
In this diagram, from a technical perspective, there are actually two Web Services: one to send the Order Status Request, and the other to separately send an Order Status Response. Note that to implement this, both Party A and Party B must have HTTP clients that can initiate web service requests as well as HTTP/Web Service servers that can generate web service responses upon receipt of a request.

Handling Intermittent Connectivity

However unlike large businesses such as Multi-National Corporations (MNCs) some businesses, especially small to medium enterprises (SMEs), may not have the 24x7 permanent internet access with fixed IP addresses required to run HTTP/Web Service servers. To handle this situation, there is a variation of the previous approach that allows just one side to be an HTTP client, with the other is an HTTP server, as in diagram 4 below.
In this example, the Order Status Request is sent, on its own, by Party A, the SME, and in return Party B, the MNC sends an acknowledgement to indicate that the request has been received. Party B then carries out the manual process and generates and then stores the result. Party A then retrieves the result of the original Order Status Request by sending a “Result Request” to Party B that identifies the earlier request and which causes Party B to send the Order Status Response back on the HTTP Response.

But what if Party B was the business with intermittent connectivity (e.g. an SME) who could not, or did not want to, run an HTTP/Web service server?

In this case another variation can be followed as indicated in Diagram 5 below.
In this case Party A wants to send an Order Status Request message to Party B, the SME. But the SME is not permanently connected and does not run an HTTP/Web service server. In this case, Party A stores the order status request message in a message store and waits for Party B to ask if there any messages. So, when Party B sends the Any Messages Request message, Party A sends in response the Order Status Request.

Party B can then process the Order Status Request and, when it is ready, send the Order Status Response to Party A in an HTTP Post. Party A can then respond with an acknowledgment in the HTTP response to indicate that it has been received.

Automatic Order Status updating can be achieved by Party ‘B’ subsequent to the original Order Status Request from Party ‘A’. As an extension of the above scenario, Party ‘B’ can retain the original status request from Party ‘A’ and periodically compare the status to the current information to determine if any further changes to status have occurred. If the status has changed, Party ‘B’ can generate and post an OrderStatusResponse predicated upon the original status request.

**Message Polling**

The last two examples (figures 4 and 5) are, in principle, the same and obey the following principles:

The Party that is permanently connected (e.g. the MNC) stores messages as the other party (e.g. the SME) is intermittently connected. Note that the messages that are stored can be:
- New request messages, e.g. an Order Status Request, or
- Response messages, e.g. a message generated as a result of an earlier request such as an Order Status Response

The Party that is intermittently connected (e.g. the SME) periodically “polls” the party that is permanently connected, (e.g. the MNC) to ask if there are any messages. As a result the permanently connected party returns all the messages for the non permanently connected party (both requests and responses)

Note that if neither party is permanently connected, then this approach does not work.

**Using WS Reliable Messaging**

The last three examples (figures 3, 4 and 5) included the sending of an “Acknowledgement” message to indicate that a message was received. One alternative to this is to use the WS Reliable Messaging Specification, currently being developed by the OASIS\(^2\). An example of the reliable messaging protocol from the March 16, 2006 committee draft of the specification\(^3\) is copied below.

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\(^3\) [http://docs.oasis-open.org/ws-rx/wsrm/200602/wsrm-1.1-spec-cd-03.pdf](http://docs.oasis-open.org/ws-rx/wsrm/200602/wsrm-1.1-spec-cd-03.pdf)
In this example, multiple messages are being sent in sequence and the “Sequence Acknowledgement” indicates to the sender of the message, which messages have been received. Note that it is possible to send single messages as well as sequences.

The effect of using WS Reliable Messaging would be to remove all the acknowledgment messages in the earlier diagrams so that each message becomes an execution of the WS Reliable Messaging protocol, such as in the example above, but transferring one “business” message. Note that WS-I is starting work on a “Reliable Secure Profile”⁴

Using Asynchronous Messaging with Synchronous Business Services

All the previous examples, in diagrams 3, 4 and 5, have assumed that Party B runs a Manual Order Status Check and therefore the business process is asynchronous. However there is no reason why the same sequence of message exchanges (e.g. using messages such as “Result Request” and “Any Messages Request”) can’t be used instead with a synchronous business service (e.g. an Order Management Application). The benefit of this approach is that the same message sequences can be used whether the business service being used is implemented synchronously or asynchronously.

Web Services

Summary
So the net of this is:

- Synchronous Web Services can only be used if the business service is synchronous, i.e. it can provide an immediate response without causing the HTTP session to time out.
- If a business service is sometimes asynchronous then you may need to support synchronous as well as asynchronous versions of the same service.
- If a business service is always asynchronous, then you have to use multiple HTTP sessions with asynchronous Web Services in order to complete the business service.
- The pattern of message exchanges used is dependent on: a) whether or not the parties involved have permanent or intermittent access to the web; and b) which party can implement an HTTP/Web Service server
- For the approaches described to work, at least one of the parties involved must have Continuous Internet access and implement an HTTP/Web Service server
- WS Reliable Messaging can be used to enhance the reliability of the delivery of messages and remove the need to develop “acknowledgement” messages
- Asynchronous Web Services can still be used if the business service is synchronous, and has the benefit that the same pattern of message exchanges can be used, but at the expense of increased complexity in the protocol.
- At the business level, this is a simple request-response. This means that binding of the business level request and response messages to the underlying transport should be handled at a lower level.

Securing Web Services

Web Services security\(^5\) is concerned with three main topics:

*Message Integrity*. Preventing an unauthorized third party from altering a message without detection

*Authentication*. Checks made by the receiver of a message that the actual sender of the message was “authentic”, i.e. they were who they claimed to be

*Confidentiality*. Preventing unauthorized third parties from discovering the content of a message

*Message Integrity*

Message integrity is required to ensure that messages have not been altered in transit. For example by altering the originating user's identity, or altering data in the message.

Support for Message Integrity is usually realized by digitally signing a message with a digital certificate using the XML Signature\(^6\) standard. When the message has been received the signature can be checked to make sure the message has not been changed.

\(^5\) Note that this section is a greatly simplified overview of Web services security

\(^6\) XML Signature [http://www.w3.org/Signature/](http://www.w3.org/Signature/)
**Message Authentication**

Authentication is the process of checking where a message came from. Usually this involves the recipient of a message first checking the message integrity (see previous paragraph) followed by checking the “credentials”, such as the name of the sender, in the digital certificate used to digitally sign the message to determine the sender’s identity.

Once the identity of the sender is known, then this is compared with the content in the message (e.g. in an Order) to check that they are the same. If they are the same then the message is authentic.

If a message and its digital signature is preserved, then it can be used for “Non-Repudiation”, i.e. that the sender of the message cannot reasonably deny that they sent the message.

**Confidentiality**

Confidentiality is used to conceal sensitive information in messages by scrambling the message content. This is carried out by using encryption techniques that conform to the XML Encryption\(^7\) standard.

**Security and Web Services**

The XML Signature and XML Encryption specifications describe how any XML document can be protected for integrity, authentication and confidentiality. For Web Services, there are multiple parts to a SOAP message that need to be protected including the message header, that contains routing and other information, as well as in the body of the message that contains the business document, e.g. an Order.

For Web Services the Web Services (WS) Security specification\(^8\) describes how a SOAP message can be protected in a standardized way.

**WS-I Basic Security Profile**

The Web Services Interoperability Organization\(^9\) designs profiles for how multiple Web Services related standards can be used together in an interoperable way. The first of these was the WS-I Basic Profile Specification\(^10\) that described how SOAP, WSDL and UDDI are used together.

The WS-I Basic Security Profile\(^11\) builds on top of the WS-I Basic Profile creating a profile which describes how that specification should be used together with the WS Security specification to secure SOAP Messages. As of June 2006, the WS-I Basic Security Profile specification is close to completion.

**Reliable Secure Web Services**

Most business integration problems require both reliable, as well as secure, message delivery.

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\(^7\) XML Encryption [http://www.w3.org/Encryption/2001/](http://www.w3.org/Encryption/2001/)


\(^10\) WS-I Basic Profile 1.1. [http://www.ws-i.org/Profiles/BasicProfile-1.1.html](http://www.ws-i.org/Profiles/BasicProfile-1.1.html)

Web Services

To this end an activity started in the WS-I in June 2006 to develop a Reliable Secure Profile (WS-I RSP)\(^{12}\) that will describe how the WS-I Basic Security Profile and the WS Reliable Messaging\(^{13}\) specifications can be used together with the existing WS-I Basic Profile and a new version 2.0 of the same profile. The results of the WS-I RSP profile should be available in 2007.

*Web Services Specifications and Vendor Implementations*

The key benefit of standardization in areas such as Reliable Messaging and Security for Web Services is that interoperable solutions from multiple vendors should become available.

All the major software vendors have coalesced around work done in the WS-I as the definitive description of how Web Services specifications should be used in an interoperable way.

CIDX should therefore consider adopting the WS-I specifications, and the WS-I Reliable Secure Profile in particular, as their standard approach to realizing Web service interoperability for business integration.

**Appendix C: Team Participants**

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