

White Paper

Web Services External (WS-X) An AS4 Implementation at Cisco





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1 Introduction

Modern economy compels business organizations to optimize their operations. For such optimization, an organization often specializes in certain core areas, and may outsource non-core activities to other organizations. Such outsourcing results in complex inter-organizational business processes. The participant organizations employ diverse industry standards based on proprietary and Internet protocols to implement these processes.

In the recent times, web services have gained prominence as a protocol for exchanging business data for B2B interactions due to the ease of use, and ubiquitous availability of tools and skills. W3C has developed several standards such as SOAP, SwA, MTOM, WS-Security, WS Reliability, and WS-ReliableMessaging to enable the necessary quality of service required to support business transactions over web services. ebMS 3.0 [4] is the leading standard that aggregates these web services standards [6] to provide the necessary transactional features. It standardizes exception handling by defining acknowledgement receipts and errors messages, and supports message choreographies. ebMS supports a broad set of features not all of which are required by typical integration scenarios. Therefore, OASIS developed a lightweight ebMS profile, known as AS4 [3], with a core set of features.

Cloud Computing is gaining popularity as a computing trend in today's IT environment. Organizations are adopting it to solve many problems, and provide new services faster and simpler than ever before. There is a growing need for standards that would enable the cloud-based services to interoperate. AS4 is a standard that can achieve such interoperability in the cloud.

This white-paper (a) summarizes AS4 profile, (b) describes the motivation and the architecture of Cisco's AS4 framework, Web Services External (WS-X), (c) describes couple use cases of this framework, and (d) describes how AS4 addresses the challenge of cloud interoperability.

2 AS4

AS4 adopts the just-enough design principle, and defines a lightweight profile based on ebMS 3.0. It aggregates conformance profiles of ebMS 3.0, and a usage profile. AS4 profile contains necessary ebMS headers that enable message processing in a payload agnostic manner. It is similar to AS2 [2] specification except it applies to web services. Unlike AS2, AS4 has enhanced interaction patterns, and acknowledgement receipts.

The lightweight conformance profile of AS4 specifies the features for a client implementation. This profile inherits only the necessary capabilities to build a light client from the parent ebMS standard. A partner requiring lightweight integration capabilities can benefit from such a client. AS4 implements several capabilities which can be configured using the process mode parameters (pmode). We now describe a key set of capabilities of AS4.

- Acknowledgement receipts: enable reliable message delivery, and retry in the event of a lost message
- Duplicate detection and elimination: enables reliable message delivery
- Password authentication, digital signatures and encryption: confirms authenticity of the sender, and the message is unaltered in transit



- Attachments support: enables interactions with large payloads
- Error generation: reports any errors to the message sender or the message receiver
- Compression: enables interactions with large payloads
- Message exchange patterns: allow a rich variety of interactions between the sender and the receiver

Table 1 shows message interaction patterns that ebMS 3.0 specifies. It shows an example business process that may benefit from each of the interaction patterns. Note that AS4 requires support for only the simple exchange patterns, *One-Way Pull* and *One-Way Push*.

Table 1: AS4: Message Exchange Patterns

| Message Exchange Pattern | Description | Client Type | Example Process |
|--------------------------|--|---|-------------------------------|
| One Way Pull | Receiver of data initiates the call; one-way transfer of business data | Ability to push to send a request, but can receive data only using pull | Order Status Query |
| One Way Push | Either sender or receiver may push data; one-way transfer of business data. | Ability to send data via push, and to receive data via push | Product Catalog update |
| Two-Way Sync | Traditional Request-Response | Regular client | Configuration Check |
| Two way Push-Push | Two one-way push MEPs in opposite directions; message in second push refers to message in first push | Ability to send data via push, and to receive data via push | Purchase Order and Response |
| Two Way Push-Pull | One-way push followed by a one-way pull both initiated by same party; pulled message refers to the previously pushed message | Ability to send data via push, but can receive data only via pull | Quote Submission and Response |
| Two Way Pull-Push | One-way pull followed by a one-way push both initiated by same party; pushed message refers to the previously pulled message | Ability to send data via push, but can receive data only via Pull | Invoice and Payment Advice |

3 Web Services Externalization (WS-X) AS4 Implementation

Cisco’s partners employ a disparate set of message exchange protocols for B2B interactions. Considering benefits such as low cost, and ease of implementation, more and more partners, especially from emerging markets, are expressing interest in implementing a lightweight messaging protocol. Cisco choose AS4 as the lightweight messaging standard since it meets all the key requirements, and it is an industry leading standard.

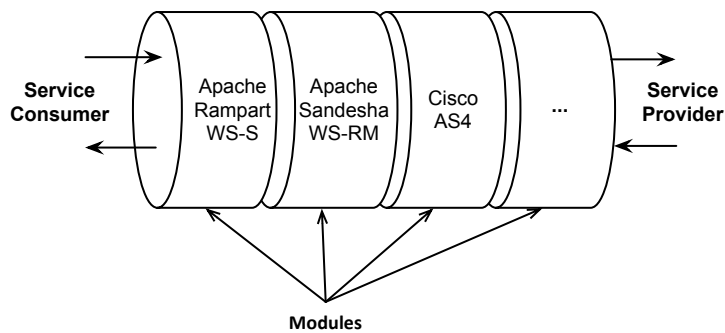


Figure 1: WS-X exploits Axis2/Java’s pluggable module architecture.

Cisco developed a framework named Web Services Externalization (WS-X) that implements AS4 profile. WS-X serves as a gateway supporting different payload formats, and ability to route the requests to the appropriate service providers. It is founded upon (a) Axis2/Java [1], an open source SOAP implementation from Apache, (b) Sandesha, Apache reliability module, and (c) Rampart, Apache security module.

WS-X exploits Axis2/Java’s pluggable module architecture, as shown in Figure 1, to implement ebMS header processing. WS-X leverages Cisco’s Web Services Gateway product to implement the security requirements. Figure 2 shows a set of adaptors that enable WS-X to invoke business services over a primary set of protocols: HTTP, JMS, and JDBC. WS-X integrates with an existing monitoring system to provide end-to-end tracking and monitoring of the flow of business documents.

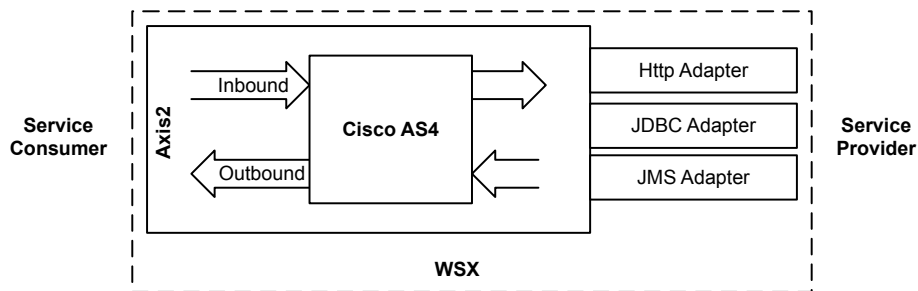


Figure 2: WS-X invokes business services via adaptors.



4 Use Cases

4.1 Service Quoting: PIP over AS4

Cisco sells networking products and support services on those products. The partners of Cisco use an application with a rich graphical user interface (GUI) to create a support services quote. The application transforms the quote to RosettaNet 3A1 [5] format, and sends it as an input to Service Quoting web service. An earlier version of this web service was synchronous, and used RosettaNet MMS standard. The GUI blocks until the Service Quoting web service responds. This web service functioned correctly for smaller quote requests, but it frequently timed out for larger quote requests.

To address the time out issue, Cisco employed AS4 based WS-X framework. Instead of synchronous interaction, the new implementation is asynchronous. It employs AS4's *one-way push*, and *pull* interaction patterns. The GUI permits submission of new quote requests even when an older request is still being processed. Due to the payload agnostic nature of AS4, the new solution is able to reuse RosettaNet 3A1 format of the quote.

In the new solution, instead of directly invoking the Service Quoting web service, the GUI sends the 3A1 quote request to WS-X. WS-X validates the request headers, and determines the destination service endpoint and an integration adaptor. In this use case, the destination service is Service Quoting service, and the integration adaptor is JMS. WS-X routes the 3A1 quote request to the Service Quoting service, and immediately sends an ebMS receipt to the GUI acknowledging receipt of the request. At a later time when Service Quoting service completes processing of the quote request, it sends a response to the WS-X framework. The GUI checks for the quote response using the *pull* pattern in an asynchronous manner, that is, without blocking the user from creating another quote. WS-X stores the quote response in a temporary data store. An ebMS acknowledgement receipt from the GUI indicates either success or failure in delivering the quote response. In case of any errors, WS-X sends ebMS error code, and a message back to the GUI. The end-to-end tracking and monitoring tool provides visibility into each stage of the message processing enabling corrective action.

4.2 Rebates Web Service: OAGIS over AS4

Wikipedia defines rebate [7] as an amount paid by way of reduction, return, or refund on what has already been paid or contributed. It is a type of sales promotion marketers use primarily as incentives or supplements to product sales. Rebates are often used by manufacturers as a means of sales promotion.

Cisco offers rebates to its partners based on various business criteria. For effective purchase planning, the partners require the rebates information. In the past, partners manually downloaded the relevant rebate data from a web-based application, and uploaded that data into their system. Recently, Cisco implemented an AS4 based rebates web service that provides an automated way for the partners to receive the rebates information. The web service provides a rebates report which the partners use to track their rebates. It improves their planning efficiency by reducing estimation delays.

The rebates web service employs AS4 based WS-X framework, and Quote OAGi BOD as the payload. A partner sends a rebates request to WS-X. After validating the request, WS-X forwards it to the rebates web service. WS-X employs the HTTP/SOAP adaptor for invoking the rebates web service.

5 AS4 - A Player In Inter-cloud Integration

Cloud computing is quickly becoming dominant in IT. A number of vendors are providing cloud-based services. As more and more enterprises rely on cloud-based services, there is a growing need to integrate these hybrid services. To achieve interoperability among these services, it is important to employ suitable standards.

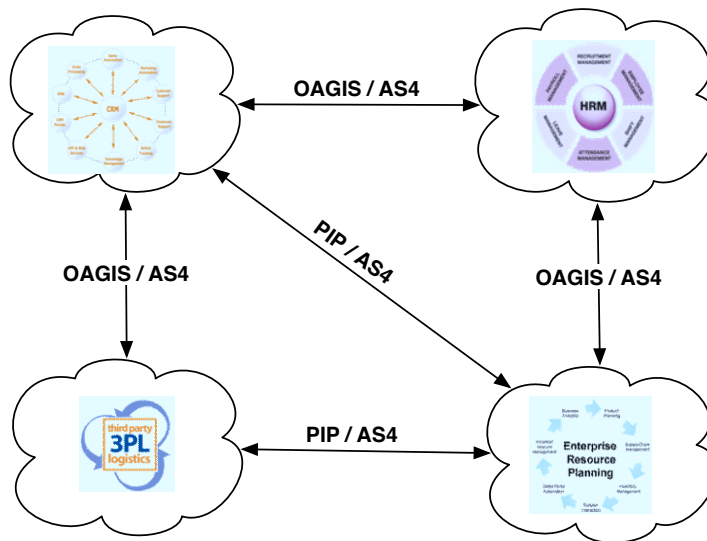


Figure 3: AS4: Interoperability in the cloud.

The two key layers that make up an integration stack are the messaging layer, and the payload layer. To achieve cloud interoperability, we are of the opinion that AS4 is the appropriate standard for the messaging layer. The payload layer may use either OAGIS or PIP standard. Figure 3 shows four cloud providers that an enterprise uses. It shows how the interactions between the cloud providers use AS4 for the messaging layer, and either OAGIS or PIP for the payload layer.

6 Conclusion

AS4 is a lightweight profile based on ebMS 3.0. It aggregates conformance profiles of ebMS 3.0, and a usage profile. AS4 profile contains necessary ebMS headers that enable message processing in a payload agnostic manner.

Cisco developed a framework named Web Services Externalization (WS-X) that implements AS4 standard. WS-X has successfully addressed several key challenges related to Cisco's web services. Using WS-X, Cisco is able to offer various synchronous and asynchronous interaction patterns to its partners.

A key challenge in cloud computing is the interoperability among various cloud providers. This will continue to be a challenge until interoperability requirements are standardized to support high tech business exchanges. AS4 appropriately address this challenge for the messaging layer. Cisco strives to leverage standardized messages, as provided by industry organizations such as OAGIS and RosettaNet,



for the payload layer. The combination of standardized transports and standardized message content can facilitate critical adoption levels, continuing to drive costs down, and improve time to capability, for business exchanges over the Internet.

References

- [1] Apache Software Foundation. Axis2/Java, 2010. <http://ws.apache.org/axis2/>.
- [2] Drummond Group. AS2, 2010. <http://www.drummondgroup.com/html-v2/standards.html>.
- [3] Drummond Group. AS4, 2010. <http://www.drummondgroup.com/html-v2/as4.html>.
- [4] OASIS. ebMS 3.0, 2010. http://www.oasis-open.org/committees/download.php/24618/ebms_core-3.0-spec-cs-02.pdf.
- [5] RosettaNet. RosettaNet, 2010. <http://www.rosettanet.org>.
- [6] W3C. Web Services Standards, 2010. <http://www.w3.org/standards/webofservices/>.
- [7] Wikipedia. Rebate, 2010. [http://en.wikipedia.org/wiki/Rebate_\(marketing\)](http://en.wikipedia.org/wiki/Rebate_(marketing)).



7 About the Authors

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8 About Cisco Systems, Inc.

Cisco Systems, Inc. is the worldwide leader in networking for the Internet. Today, networks are an essential part of business, education, government and home communications, and Cisco Internet Protocol-based (IP) networking solutions are the foundation of these networks.

Cisco hardware, software, and service offerings are used to create Internet solutions that allow individuals, companies, and countries to increase productivity, improve customer satisfaction and strengthen competitive advantage. The Cisco name has become synonymous with the Internet, as well as with the productivity improvements that Internet business solutions provide. At Cisco, our vision is to change the way people work, live, play and learn.