D Technology Update To Initial Publication

Things move quickly in the world of Web services! Since we completed the first edition of *Perspectives on Web Services* in May 2003, the IBM WebSphere portfolio has changed significantly. This short update outlines the major changes and suggests alternative approaches to enable readers to complete the examples in the Development and Operational Perspectives with the latest releases of the products.

Our intention is to complete a second edition in 2005 with completely reworked examples with the shiny new WebSphere 6.0. We hope this new chapter will satisfy your appetite until then!

Olaf, Mark and Stefan, December 2004

D.1 Overview

This section provides an overview of the industry changes since the initial publication, and explains how the IBM WebSphere development and runtime tools have been adapted to support these.

D.1.1 Goodbye Apache SOAP – Hello JAX-RPC!

When we initially authored the book, WebSphere Application Server version 5.0 had only just been launched, and most users were still working with version 4.0. It was also true to say that, at the time, all of the Web services projects we had been involved in had been using the Apache SOAP engines with success.

The WebSphere SDK for Web Services (WSDK) at the time was a glimpse into the future – a technical preview of how the Web services programming model would ultimately evolve from the proprietary IBM and Apache APIs to a new standards base in J2EE 1.4. By featuring both platforms in our first edition, we hoped to ensure that the book had a slightly longer usefulness (and shelf life!) than most of the others in the bookstores at the time.

However, like many early adopters, we require a migration effort now the technology has become mainstream: WebSphere Application Server 5.0.2, available only shortly after our initial publication, provided the first production-ready support for the JAX-RPC and JSR 109 standards. Overnight, about 100 pages of our publication became obsolete.

If your planned Web services project is looking for an IBM solution today – we would now strongly encourage you to use a JAX-RPC and JSR 109 implementation instead of Apache SOAP 2.3. This will provide you with portable, standards-based code and less of a migration headache when even newer releases come along. You will also benefit from better performance and improved tools – aspects we intend to focus on in the remainder of this new chapter.

Is the WebSphere 5.x JAX-RPC engine the same as Apache Axis?

No. The IBM JAX-RPC implementation shipped with WebSphere 5.0.2 and above is a completely different code base to the second-generation Apache Axis open source implementation.

The two share the same programming interfaces, but Axis uses its own deployment descriptors instead of the standardized JSR 109 ones. Initial IBM benchmarks comparing the IBM release against Axis showed twice the throughput under load. This, in conjunction with the IBM support, makes the case very compelling for its use within projects.

There are, however, scenarios where we would advocate and have seen the successful use of Apache Axis with WebSphere. The most prevalent of these is when projects are still delivering applications on WebSphere Application Server version 4.0 (whose support is currently scheduled to end in August 2005) with non-functional performance requirements which would not be met by the Apache SOAP implementation in the product.

D.1.2 Moving from rpc/encoded to document/literal

The Web Services Interoperability Organization's (WS-I) Basic Profile version 1.0 has had a predictably large impact on the Web services community and the vendors which support it.

The most notable of the changes has been the almost universal adoption of the document/literal style of service invocation, moving the rpc/encoded style into obscurity. In Section 3.6.1 of the book, 'The XML Language Binding and Encoding Maze', we detailed the advantages and disadvantages of each approach and recommended rpc/encoded primarily for the productivity gains from the tooling support at the time. The complexity of the programming required in the document/literal sections of the Development Perspective fully supported this advice at the time.

However, with the next generation releases of the development tools, we now see full support for both styles (document/literal typically being the default), as well as the more exotic combination of rpc/literal. Today there is very little reason to use rpc/encoded, except for backward compatibility and interoperability with older Web services communication stacks.

August 2004 then saw the publication of version 1.1 of the Basic Profile[1], and this is now supported in the very latest releases of the IBM development environment and runtime.

D.1.3 WebSphere Application Server Evolution

Figure D.1 below illustrates the evolution of the WebSphere Application Server over the past two years.

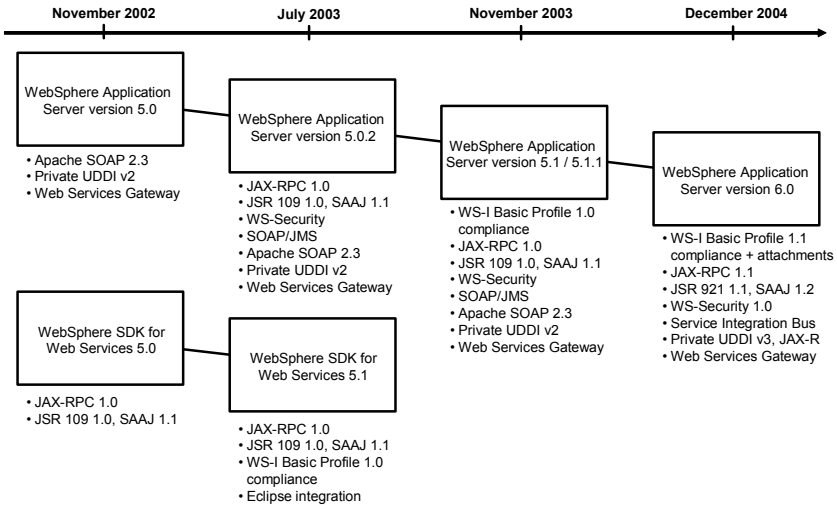

Fig. D.1 Evolution of WebSphere Application Server

At the time of initial publication, 5.0 was the most current version of the application server, which only supported Apache SOAP 2.3 for Web service communication. 2003 saw the introduction of versions 5.0.2 and 5.1 in quick succession, which delivered production support for JAX-RPC, JSR 109 and WS-Security and finally compliance with the WS-I Basic Profile 1.0.

In our experience, most users are now finalizing their migrations to the extremely stable version 5.1 prior to the withdrawal of support for version 4.0 (version 5.1.1.2 being the very latest at the time of writing). This is an excellent platform for Web services deployment, and would be our recommended version for most new projects today.

WebSphere version 6.0 has also just arrived on the scene and is now available with J2EE 1.4 support for the most demanding and technologically advanced user. It brings minor updates for most of the core Web services APIs (including the re-

[1] You can download version 1.1 of the WS-I Basic Profile from http://www.ws-i.org/Profiles/BasicProfile-1.1.html

placement for JSR 109 in J2EE 1.4, JSR 921) along with new integration techniques based on a technology known as the Service Integration Bus.

The WebSphere process orchestration technology has also evolved, and this is illustrated in Figure D.2.

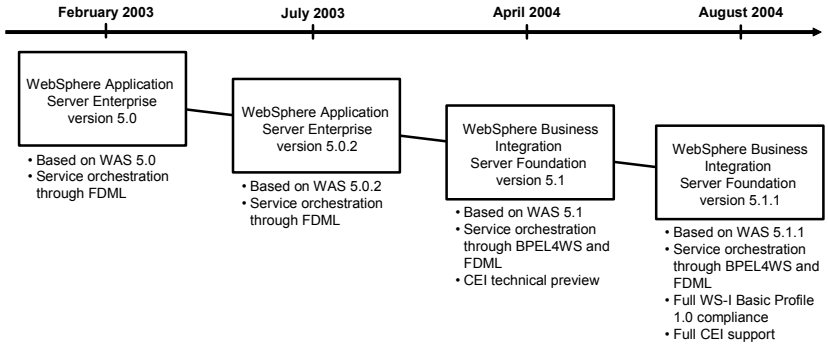

Fig. D.2 Evolution of WebSphere Application Server Enterprise

In the first edition of the book, Section 4.13, 'Orchestrating Web Services', explained how to use WebSphere Application Server Enterprise's support for the proprietary Flow Definition Markup Language (FDML) to orchestrate Web services together into a business process.

Again, the industry has seen a huge standardization effort over the past two years to establish common markup languages for describing business processes. The most prevalent of these has been the Business Process Execution Language for Web Services (BPEL4WS or just BPEL to its friends)[2]. IBM became one of the early advocates of the standard, and adopted it in the re-branded successor to WebSphere Application Server Enterprise – *WebSphere Business Integration Server Foundation 5.1*. This pure-J2EE process orchestration platform has generated significant interest amongst early adopters, and we are beginning to see its use in a number of pilot projects. The most recent release, version 5.1.1, has also seen the introduction of full support for the IBM Common Event Infrastructure (CEI) event management and distribution technology, which is based on the proposed Common Business Event (CBE) OASIS specification.

[2] The BPEL4WS specification was initially launched as a joint specification between IBM, BEA and Microsoft. You can download the initial public draft from: http://www.ibm.com/developerworks/webservices/library/ws-bpel1/. The specification is now under the control of the Web Services Business Process Execution Language (WSBPEL) Technical Committee at OASIS, which is integrating it with other initiatives such as the Business Process Markup Language (BPML) and the Web Service Choreography Interface (WSCI). You can read about the committee's work at: http://www.oasis-open.org/committees/wsbpel.

D.1.4 WebSphere Studio Evolution

WebSphere Application Server and WebSphere Studio have always evolved together, with each new release of the runtime being supported by accompanying tools. As the application server introduced formal support for JAX-RPC, JSR 109, WS-Security and WS-I Basic Profile compliance, complementary features have been added to the IDE.

Figure D.3 below shows the evolution of WebSphere Studio Application Developer, the tool used for the large proportion of the exercises in the Development Perspective.

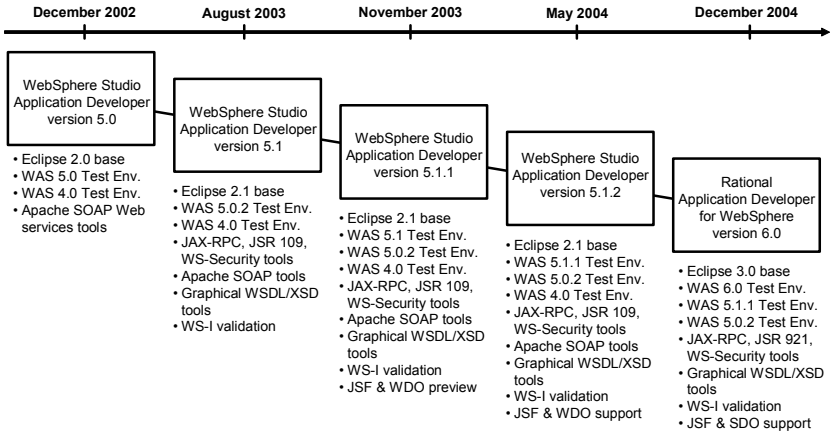

Fig. D.3 Evolution of WebSphere Studio Application Developer

In general, we recommend that users adopt the most recent version of the IDE regardless of the target runtime environment. Until recently this was version 5.1.2, which supported both the 5.1.1, 5.0.2 and 4.0 runtime environments simultaneously. However, if you do not have a requirement to maintain WebSphere Application Server version 4.0 applications, we would now encourage the use of the recently re-branded *Rational Application Developer for WebSphere version 6.0*. This product contains all of the previous features of the WebSphere Studio IDE, but is based on the latest Eclipse 3.0 technology and delivers support for WebSphere Application Server version 6.0 and J2EE 1.4.

In conjunction with the release of Rational Application Developer version 6.0, IBM also announced a completely new tool called *Rational Software Architect version 6.0*. This product provides all of the features of Application Developer, but adds a UML 2.0 modeling environment complete with UML language transforms to simplify the design of model-driven architectures.

WebSphere Studio Application Developer Integration Edition, the extension to Application Developer which delivered modeling support for FDML processes for

deployment to WebSphere Application Server Enterprise edition, has also continued to evolve, and its progress is illustrated in Figure D.4.

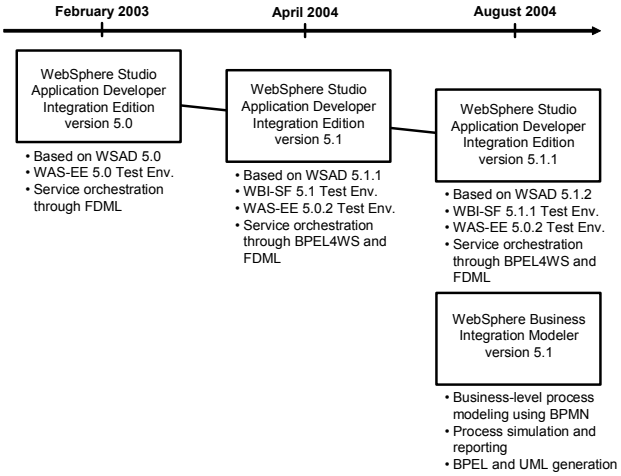

Fig. D.4 Evolution of WebSphere Studio Application Developer Integration Edition

Each major release of the WebSphere process orchestration runtime has seen an accompanying release of Integration Edition. The introduction of BPEL support was first announced in early 2004 with an all-new graphical process designer to replace the primitive tools in the earlier editions. 2004 has also seen the introduction of an accompanying Eclipse-based business-level modeling product called WebSphere Business Integration Modeler version 5.1. This tool allows analysts to use the *Business Process Modeling Notation (BPMN)*[3] to describe existing or new business processes and simulate their characteristics prior to generation and deployment of the process in BPEL.

D.1.5 Farewell to the WSDK

The free-to-download IBM WebSphere SDK for Web Services (WSDK) was designed as an interim solution between the WebSphere Application Server 5.0 and 5.1 releases. It served its purpose well, as both an early preview of a JAX-RPC and JSR 109 specification implementation and as a test platform for WS-I Basic Profile compliance and interoperability testing. It survived two releases – 5.0 and 5.1, but became redundant once WebSphere Application Server 5.1 was released.

[3] BPMN is a graphical notation defined by the Business Process Management Initiative. You can obtain the version 1.0 specification at http://www.bpmn.org.

The WSDK provided both the command line code generation tools and runtime environment for the JAX-RPC and JSR 109 examples in the first edition of the book. However, it has now been withdrawn and cannot be downloaded from the IBM site using the previously published URL.

Early access to other new Web services technologies is still provided through the IBM alphaWorks Emerging Technologies Toolkit (ETTK)[4]. At the time of writing, version 2.2 of the ETTK provides early implementations of Semantic Web Services, WS-Agreement, WS-ResourceFramework, WS-Notification and WS-Addressing.

D.1.6 Useful downloads

All of the products we have featured have trial versions available for download from the IBM site. Each of these is typically time-bombed for 60 days, but this should be enough time to work your way through the samples.

We recommend that you initially download a development environment, as these also include the runtime as an integrated test environment. However, to complete some of the exercises in the Operational Perspective, you must also have the full application server runtime available.

The following trial products are available for download at:

http://www.ibm.com/developerworks/websphere/downloads/

- WebSphere Studio Application Developer version 5.1.2
- WebSphere Studio Application Developer Integration Edition version 5.1.1
- WebSphere Business Integration Modeler version 5.1
- WebSphere Application Server version 6.0

A New Site for *Perspectives on Web Services* Readers

When the first edition of the book was published, we had not completed the construction of the accompanying Web site. Therefore, the book referred readers to our page on the Springer Web site, http://www.springer.de. Since then, we have launched http://www.perspectivesonwebservices.de as a comprehensive source for all information and downloads related to the book.

D.1.7 Conclusions

So which products should you select today? If you plan to work through the examples in the first edition's Development and Operational Perspectives, we recommend that you initially start working with WebSphere Studio Application Developer 5.1.2 and WebSphere Application Server 5.1.1. The following sections in this chapter will give an overview of how to use these new products to complete

[4] You can download the ETTK from http://www.alphaworks.ibm.com/tech/ettk

this chapter will give an overview of how to use these new products to complete the older examples. Our planned second edition will then complement this supplementary information with details on how to work with the J2EE 1.4-compliant Rational Application Developer for WebSphere and WebSphere Application Server version 6.0.

D.2 Updates to the Development Perspective

This section provides details on specific Web services tooling changes between WebSphere Studio Application Developer versions 5.0 and 5.1.2. This should allow you to complete the previous Development Perspective exercises with the new tools. Each subsection will focus on a different aspect of Web services development.

D.2.1 Introduction

As discussed previously in Section D.1.4, WebSphere Studio now includes support for both IBM's JAX-RPC and JSR 109 implementation and Apache SOAP 2.3. This support is exposed as some additional options which appear on the second page of the Web services wizard, as shown in Figure D.4 below.

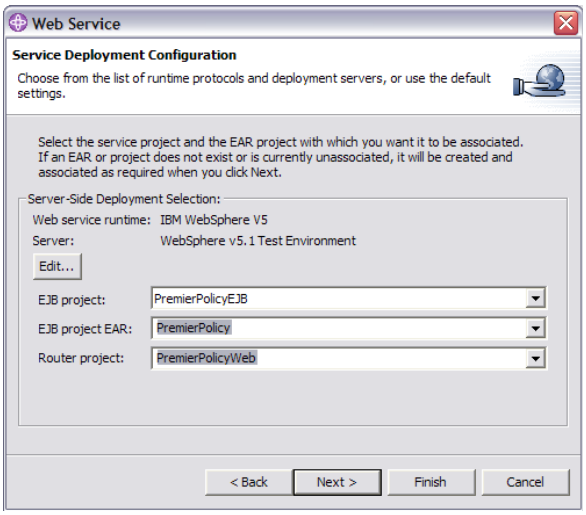

Fig. D.5 Service Deployment Configuration page in Web services wizard

Two useful pieces of information are presented on this dialog: the selected Web service runtime and the target application server version. The default values are the IBM JAX-RPC and JSR 109 implementation with WebSphere Application Server version 5.1.1. Should you wish to change these, click on the *Edit*... button. The dialog shown in Figure D.6 is displayed.

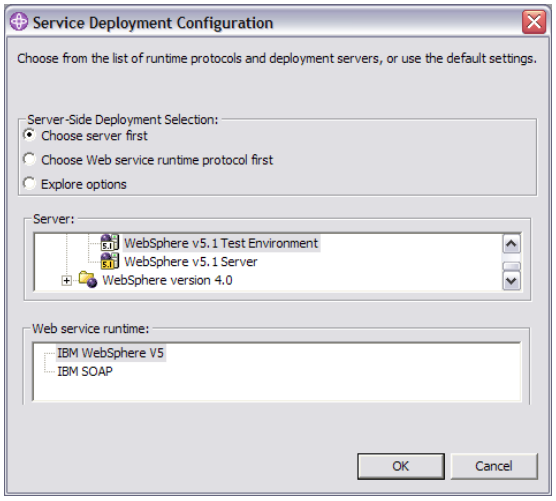

Fig. D.6 Selecting a different Web service runtime.

The terms used in this dialog are admittedly confusing – selecting the *IBM WebSphere V5* Web service runtime creates a project which utilizes the JAX-RPC and JSR 109 support. Selecting *IBM SOAP* as the Web service runtime switches to the older Apache SOAP 2.3 implementation.

Additional options are now also available in the tool's preferences pages. Selecting the *Window -> Preferences* menu from the IDE shows a number of categories, the most important of which is under *Web Services -> WS-I Compliance*. This is shown in Figure D.7.

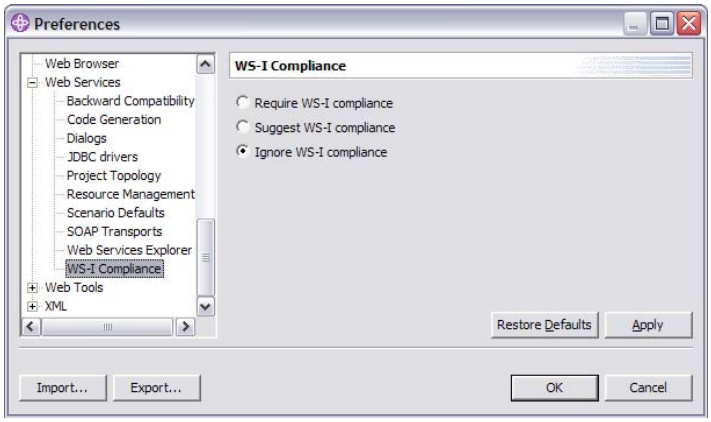

Fig. D.7 WS-I Compliance preferences in WebSphere Studio

Three options are available. Selecting *Require WS-I compliance* enforces the rules defined in the Basic Profile version 1.0, and prevents users from continuing in wizards when non-compliant options have been selected. The *Suggest WS-I compliance* option performs the same validation as the first choice, but only displays a warning dialog which can then be dismissed when non-compliant services are being built. The final option, *Ignore WS-I compliance*, disables all WS-I validation and gives the user 'carte blanche' to develop whatever they want without interruption. We recommend selecting the second option, *Suggest WS-I compliance*, when running through the examples.

D.2.2 Preparing the Sample Application

Section 4.3 and Appendix A of the first edition described how to build a simple J2EE 1.3 application which utilized Cloudscape as its underlying relational database and deploy it to WebSphere Application Server.

The version of Cloudscape shipped with the WebSphere products has not seen any major changes between the two versions of the product, although it has advanced from version 5.0 to 5.1. This may change in future releases, as IBM has recently open-sourced Cloudscape to the Apache Derby[5] incubator project.

If you plan to use the WebSphere Application Server version 5.1.1 test environment, change all of the paths from `x:\wsad\runtimes\base_v5\java` to `x:\wsad\runtimes\base_v51\java`[6].

With this minor change, you should be able to complete Sections A.1.1 through to A.4.3 without any problems. Section A.5 is not necessary as you should now not be using the WSDK.

D.2.3 Building rpc/encoded Services

Section 4.4 of the Development Perspective introduced the reader to the WebSphere Studio Web services tools for the first time, and took them through the development of an rpc/encoded service from a Session EJB Façade.

As we discussed in Section D.1.2, rpc/encoded services have become less popular since the widespread adoption of the WS-I Basic Profile version 1.0, and this is no longer our recommended approach for Web service development. However, it is still possible to generate services using this style within WebSphere Studio.

During the generation of the Web service from an EJB in Section 4.4.2, new options appear in the Web services wizard as shown in Figure D.8. Note that *Document/Literal* is now the default style, and *RPC/Encoded* must be selected explicitly.

---

[5] For more information about the Apache Derby incubator project see: http://incubator.apache.org/projects/derby.html

[6] Where `x:\wsad` is your WebSphere Studio installation directory

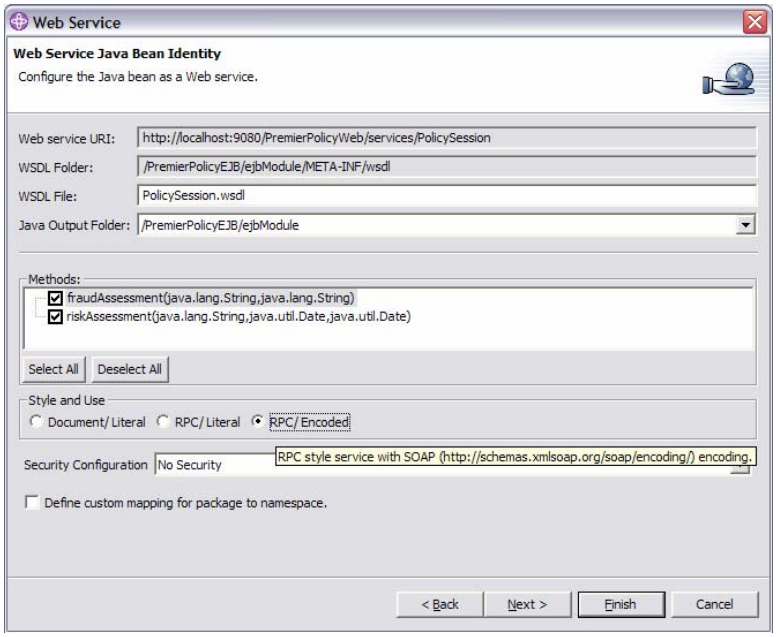

Fig. D.8 Creating an rpc/encoded Web service with the Web services wizard

If WS-I compliance testing is enabled, you should now see the warning shown in Figure D.9. This can be dismissed by clicking on the *Ignore* button, but warnings will continue to be displayed in the task list by the WS-I validator once generation has been completed.

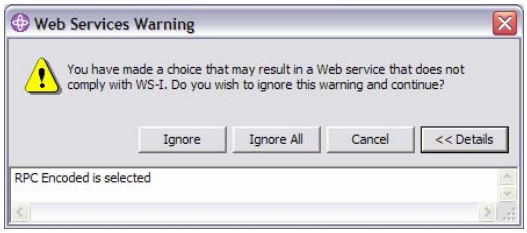

Fig. D.9 WS-I compliance warning

When browsing the generated artifacts you will see that the JAX-RPC Service Endpoint Interface (SEI) has been generated along with a JSR 109 deployment descriptor, `webservices.xml`, in the EJB project's `META-INF` folder. Opening this deployment descriptor displays a new Web services editor, which provides a simple way of modifying the deployment characteristics on the Web services in the

project. This is shown in Figure D.10, and will be investigated in more detail in the following sections.

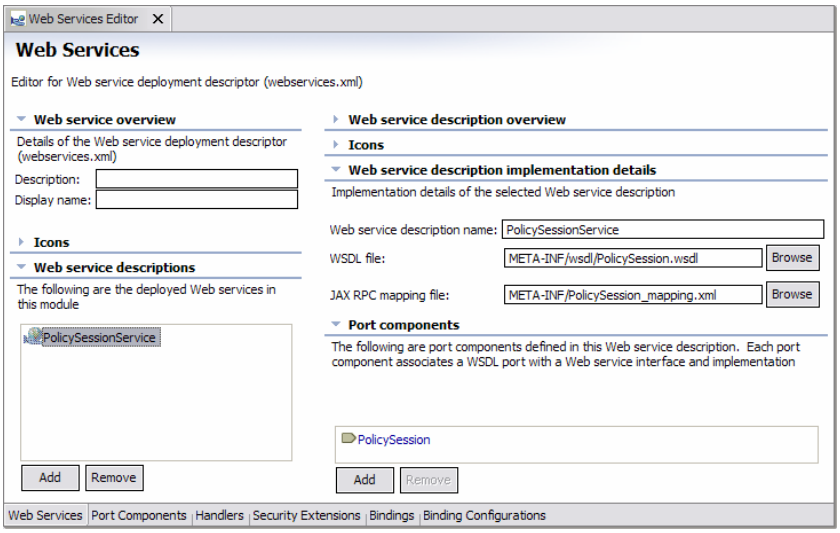

Fig. D.10 `webservices.xml` deployment descriptor editor

The final relevant feature in the latest release of WebSphere Studio is the enhanced WSDL editor. When opening the generated `PolicySession.wsdl` file from the Web project's `WebContent\wsdl` folder structure, you should see an editor similar to that in Figure D.11.

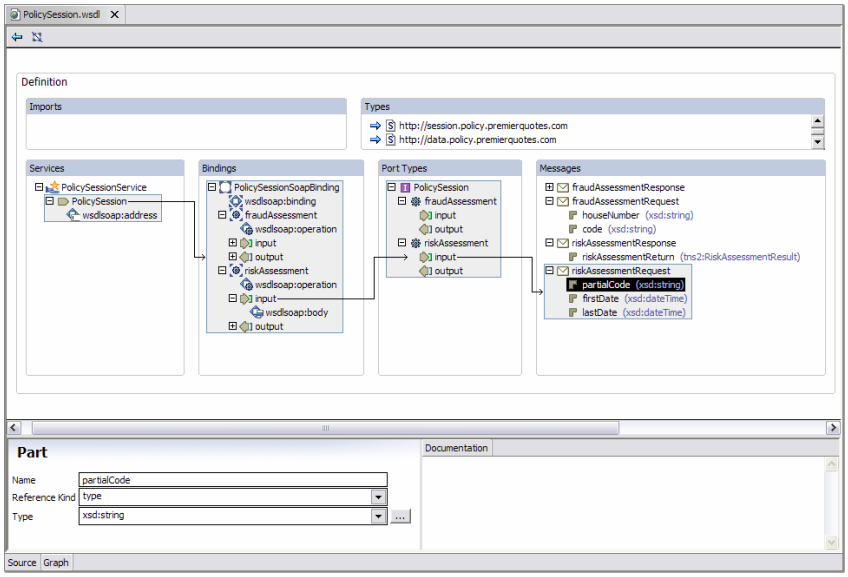

Fig. D.11 WebSphere Studio graphical WSDL editor

This new graphical editor takes all of the complexity out of viewing, creating and editing WSDL documents. It is able to show the linkages between the service interface, binding and implementation elements of both single and split WSDL files and additionally allows the user to navigate through the XML schema types imported into each interface. You should never need to hand-code WSDL again, even when working in a top-down scenario.

The "Split WSDL" option's absence in WebSphere Studio

One of the WS-I Basic Profile recommendations is to separate the service interface, binding and implementation sections of your WSDL into separate documents to maximize reuse of their elements. When working with Apache SOAP 2.3 in WebSphere Studio 5.0, you could specify different filenames for each element. WebSphere Application Server 5.1's own command line tool, `Java2WSDL` also provides a `-outputImpl` option which creates a separate service implementation WSDL document. However, all of these options are absent in WebSphere Studio version 5.1.2's wizards, along with the ability to generate external (i.e. "not inline") XML schemas to represent your complex data types.

Should you wish to adopt the split WSDL approach, unfortunately you must modify the generated WSDL by hand, although the new graphical WSDL editor simplifies this task.

D.2.4 Building Web Service Clients

The Web service client wizard in WebSphere Studio now supports JAX-RPC and JSR 109 in addition to its previous support for Apache SOAP 2.3. It also adds client generation for Apache Axis 1.0. When working with the examples in Section 4.5 of the Development Perspective, you will again see an additional page added to the wizard which enables the selection of the client-side Web service engine. This is shown in Figure D.12 below:

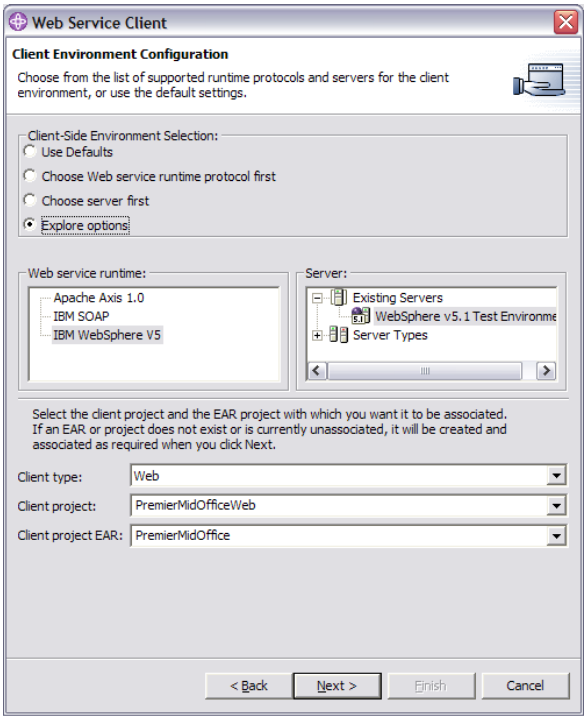

Fig. D.12 Client-side environment selection in the Web services client wizard

As we discussed in Section D.2.1, the *IBM WebSphere V5* option utilizes the WebSphere 5.1.1 JAX-RPC and JSR 109 support. Selecting *IBM SOAP* enables the project for Apache SOAP 2.3 support, and finally selecting *Apache Axis 1.0* generates artifacts and deployment descriptors which are compatible with the second-generation open source implementation. Our recommendation here is to stick to the *IBM WebSphere V5* option.

The generation process creates a JAX-RPC service endpoint interface (SEI), service interface and client stub, along with a client-side proxy to invoke the service. It also generates a JSR 109 client-side deployment descriptor, `webservicesclient.xml`, in the `WebContent\WEB-INF` folder. Opening this

file in WebSphere Studio launches a new Web service client editor, as shown in Figure D.13.

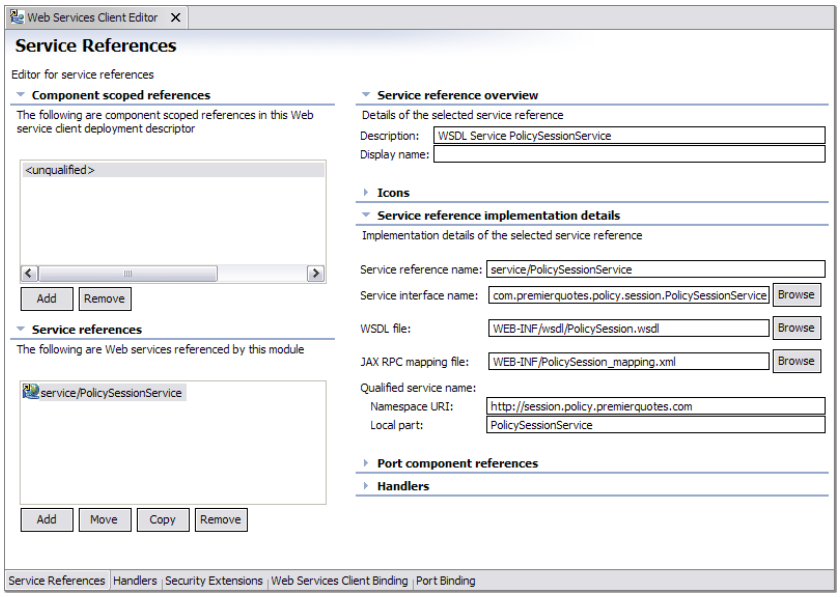

Fig. D.13 `webservicesclient.xml` deployment descriptor editor

This new editor provides a simple way of modifying the characteristics of the Web services client in a similar way to the server-side editor shown in Figure D.10. We will investigate some of its features in later sections.

D.2.5 Building rpc/encoded Services from WSDL

To complete the top-down example in Section 4.6 of the Development Perspective, very few modifications are required. The new JAX-RPC-friendly Web services wizard is able to create a Java bean skeleton (and now also an EJB skeleton) from an existing WSDL file. During the generation process, it additionally creates an SEI for the Java bean skeleton and a server-side JSR 109 deployment descriptor, populated with information about the location of the implementation.

D.2.6 Programmatic Access to WSDL

WebSphere Studio 5.1.2 continues to distribute the JWSDL implementation, WSDL4J, in the `x:\wsad\runtimes\base_v51\lib` directory as previously

described in Section 4.7 of the Development Perspective. No modifications are required to complete the example with the new software releases.

D.2.7 Using WS-Inspection to Build Service Indices

Section 4.8 of the first edition of *Perspectives on Web Services* described how to use the Apache Axis WSIL4J subproject toolkit to create WS-Inspection indices of Web services as a lightweight alternative to UDDI.

Although WS-Inspection has not been widely adopted, WebSphere Studio has delivered further integration into the IDE, with service indices being generated by the Web service client wizard as an additional option. This is illustrated in Figure D.14 below.

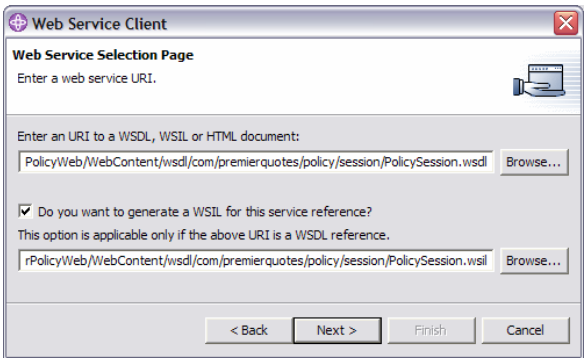

Fig. D.14 Creating WS-Inspection indices in the Web service client wizard

This WS-Inspection document generation removes the requirement to hand-code the indices as previously described in Section 4.8.2 of the first edition.

D.2.8 Using UDDI

There have been no major changes to the UDDI support in WebSphere Studio between versions 5.0 and 5.1.2, and as such, readers should be able to complete Section 4.9 of the previous edition without any modifications being required.

WebSphere Application Server version 6.0 introduces two new technologies – UDDI version 3.0 for the unit test registry and support for JSR 93, the Java API for XML Registries 1.0 (JAXR) specification[7]. We intend to describe their usage scenarios with Rational Application Developer for WebSphere version 6.0 in our second edition.

[7] For more information on JAXR, see the specification at:
http://www.jcp.org/en/jsr/detail?id=93

D.2.9 Using Other Web Services Bindings

The introduction of the Web Services Invocation Framework (WSIF) and its extensions to WSDL for Java, EJB and other bindings was covered in Section 4.10 of the first edition. The concept of using a Web services programming model without the overhead of SOAP message (de)serialization for homogenous platforms has proved extremely popular with many organizations, and we have now seen WSIF being used successfully on projects, often in conjunction with other open source frameworks such as Spring[8].

WSIF 2.0 continues to be available from both its Apache Axis subproject and as part of the WebSphere Application Server 5.x and 6.0 distributions. The open source implementation now provides pluggable providers for SOAP over HTTP (including Apache SOAP and Axis), local Java classes, EJBs, JMS services and application accessible via J2C Java connectors. It also now provides good documentation on the syntax of each of the WSDL binding extensions.

The implementation shipped with IBM WebSphere additionally includes a pluggable provider for the IBM JAX-RPC and JSR 109 Web services engine. This additional provider is defined as the default for SOAP communication, and is our preference for use with the examples in the Development Perspective. The file `x:\wsad\runtimes\base_v51\lib\wsif.jar` distributed with WebSphere Studio contains both the Apache providers and the IBM implementation.

D.2.10 Creating a document/literal Service from WSDL (Section 4.11)

Section 4.11 of the book introduced readers to the document/literal style of Web service invocation. As previously discussed in Section D.2.3 of this chapter, the more recent releases of WebSphere Studio have provided comprehensive support for this technique, and now provide this as the default option when creating new services.

In the book, we used a top-down approach, manually creating a WSDL document which imported two XML schema elements and then built a service implementation which implemented the interface. Our primary reason for this approach at the time was that the WebSphere Studio tools did not provide any mechanism for bottom-up generation of document/literal style WSDL from a service implementation.

The Web service wizard in WebSphere Studio 5.1.2 is now able to create a JAX-RPC SEI and JSR 109 server-side deployment descriptor from document/literal style WSDL document without any problems. Therefore, it should be possible to complete Section 4.11.4 of the Development Perspective using the new WebSphere Studio wizards without any further coding.

---

[8] Spring is a middle-tier interface abstraction framework / container with many features including support for aspect-oriented programming techniques. It can be downloaded from: http://www.springframework.org/

Figure D.8 earlier in this chapter showed how to use the new Web service wizard to create rpc/encoded services using a bottom-up approach. By selecting the *Document/Literal* option in this dialog, it is now just as easy to create document-style services which utilize the JAX-RPC and JSR 109 implementation in WebSphere Application Server 5.1.

JAX-RPC vs. JAXM for document/literal-Style Services

Both IBM and Microsoft have continued to use RPC-style programming techniques for both the implementation and invocation of document/literal-style services. The JCP had previously worked on the Java APIs for XML Messaging (JAXM, JSR 67) specification for this purpose, although its use has not been widespread, and there is no formal support within IBM WebSphere.

We believe the primary reason for the omission of the JAXM features is that developers find it easier to work with RPC-style APIs rather than the direct manipulation of XML elements. Fortunately, the tools by both vendors do a good job of generating classes to manipulate all but the most complex of XML schemas. However, we would argue that it would be nice to have the choice – in WebSphere 5.1, the full SOAP body is only directly available to JAX-RPC handlers via SAAJ and there is no out-of-the-box mechanism for straight through processing of the request without full de-serialization. This limitation is removed in WebSphere 6.0, where SAAJ can now also be used for the manipulation of the message body from within the service implementation.

D.2.11 Creating a document/literal Service Client

The creation of document/literal Web service clients was discussed in Section 4.12 of the book. As described earlier, advances in the WebSphere Studio tools have made working with document/literal-style services much easier, and it should be possible to complete the exercises easily with the new Web service client wizard as discussed previously in Section D.2.4.

D.2.12 Orchestrating Web Services (Section 4.13)

Section 4.13 of *Perspectives on Web Services* introduced two new products – WebSphere Application Server Enterprise and WebSphere Studio Application Developer Integration Edition. As we discussed in Section D.1.3 of this chapter, the industry adoption of BPEL has been gathering momentum, and the Enterprise edition of the WebSphere runtime has been re-launched as the BPEL-compliant WebSphere Business Integration Server Foundation version 5.1.

When creating a new business process in WebSphere Studio Application Developer version 5.1 and above, you are now presented with the option to create either a BPEL or FDML process, as shown in Figure D.15.

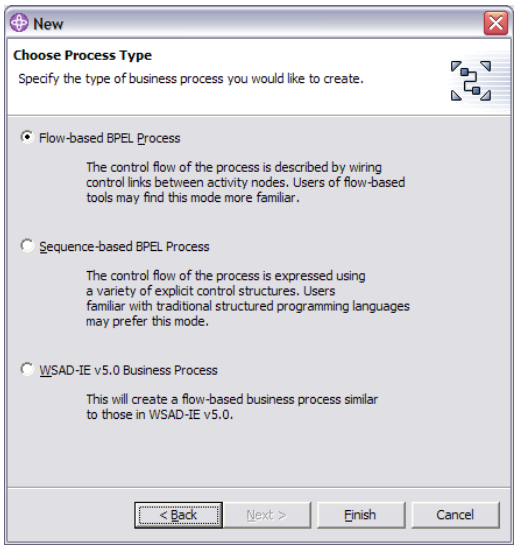

Fig. D.15 Process types supported in WebSphere Studio Application Developer Int. Ed. 5.1

BPEL provides two constructs for chaining service invocations – a *control link*, which links together two services which have been defined in any order, and a *sequence*, which requires services to be invoked in the order they are defined. Control links are derived from the IBM WSFL specification, and the sequence construct was initially defined by Microsoft in XLANG. Both are valid approaches – we recommend using the more flexible Flow-based technique with control links for your first processes.

Describing in detail how to reproduce the *CreatePolicyProcess* business process from Section 4.13 of the first edition is out of scope for this update, but Figure D.16 illustrates what the process should look like in the BPEL editor of the new tools. A variety of new terminology is used:

Partner Link Defines a contract between the process and a given service provider which outlines which WSDL interfaces will be provided by each entity in the relationship.

Invoke Activity A node within the process which invokes a single operation on a WSDL interface provided by one of the Partner Links.

Variable An instance of a WSDL message which represents either the input or output of an activity.

Correlation Set A collection of unique variable elements which can by used to identify the target process instance from an inbound message to the process.

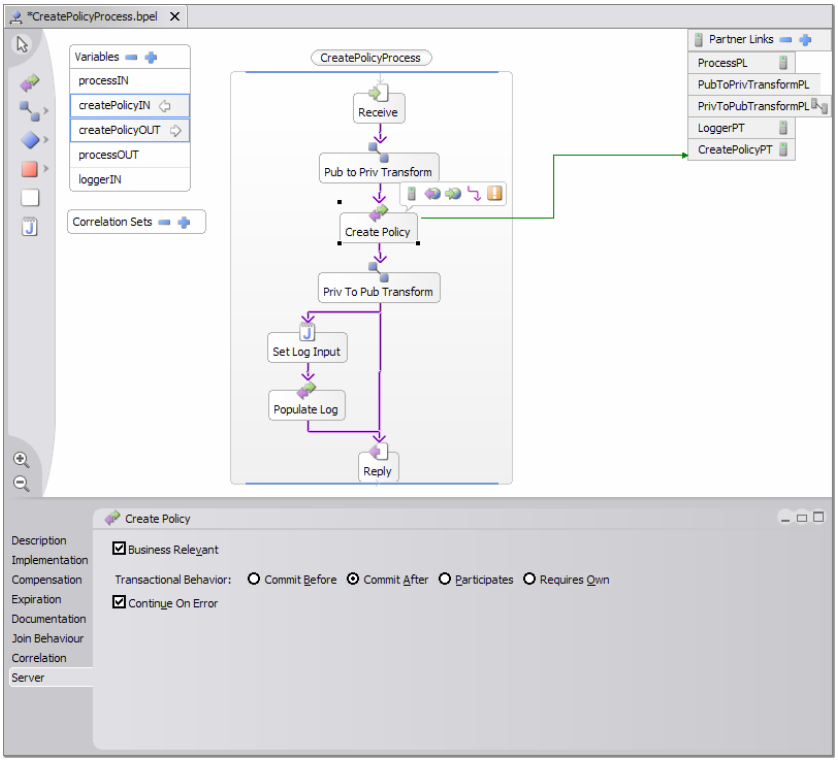

Fig. D.16 The BPEL business process editor

D.2.13 Using Attachments with SOAP

The use of SOAP with attachments has often been a feature requested by developers of Web services. Section 4.14 of the book discussed how to use the Java Activation Framework `javax.activation.DataHandler` class in the SEI in conjunction with the Web service tools to generate a service which returned an attachment.

WebSphere Studio Application Developer 5.1.2 now provides tooling support for the generation of SOAP attachments in the Web service wizard, and the exercise should now be simple to complete. Interestingly, the following WSDL message gets generated from the wizard, using `xsd:anyType` to represent the attachment:

```
<sequence>
  <element name="getAnnualReportReturn" nillable="true"
    type="xsd:anyType"/>
</sequence>
```

Interoperable Attachments and the WS-I

We have heard of a number of organizations who have tried to create interoperable Web services which utilize the SOAP with attachments feature. As it was not initially covered by the WS-I Basic Profile version 1.0, this was often problematic. The main reasons for the interoperability issues were the different standards used to describe the type of the attachment. The Java community has primarily been using MIME types to describe the content, and Microsoft chose to implement the DIME specification in its products.

Finally, the WS-I has addressed this problem with a new Attachments Profile version 1.0[9], which was published in August 2004 and complements the new Basic Profile version 1.1. Interestingly, the WS-I decided to select MIME rather than DIME as the basis for their specification.

WebSphere Application Server version 6.0 and Rational Application Developer for WebSphere 6.0 provide full compliance to both the Basic Profile version 1.1 and the Attachments Profile version 1.0.

D.2.14 Using SOAP Headers

In the first edition of the book, Section 4.15 saw us struggling to process SOAP headers in Apache SOAP 2.3, although we saw that the process was significantly easier in the WSDK due to its support for JAX-RPC handlers. The latest releases of the IBM development environment make the configuration and deployment of JAX-RPC handlers even easier through their integrated JSR 109 deployment descriptor editors.

Switching to the *Handlers* tab in either the `webservices.xml` or `webservicesclient.xml` editors provides developers with the ability to import handlers which extend the `javax.xml.rpc.handler.GenericHandler` class and associate them with SOAP roles and header namespaces. This interface is shown below in Figure D.17.

Using this editor in conjunction with the instructions in Section 4.15.3 of the book should allow for the completion of the header example without the need to edit the XML in the deployment descriptors directly.

[9] The WS-I Attachments Profile version 1.0 can be downloaded from http://www.ws-i.org/Profiles/AttachmentsProfile-1.0.html

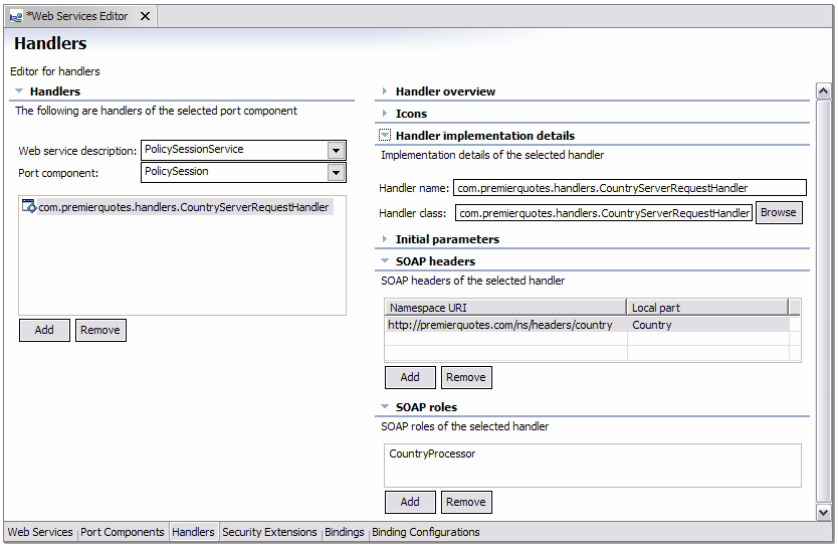

Fig. D.17 Defining a JAX-RPC handler in the server-side JSR 109 deployment descriptor

D.2.15 Conclusions

The latest releases of WebSphere Studio provide significant Web services enhancements over version 5.0. Many activities benefit from enhanced automation, and the WS-I validation features give you greater confidence that your services should[10] interoperate with other platforms.

If you have already built solutions using Apache SOAP 2.3 on either WebSphere 4.0 or 5.0, now might be a good time to consider migrating onto the JAX-RPC and JSR 109/921 implementations in either WebSphere versions 5.1 or 6.0. You will benefit from significant performance and interoperability enhancements, more portable code and superior tooling support for almost every aspect of development.

[10] Note the use of "should" rather than "will" in this sentence, as there is still no firm guarantee that the other platform with which you are interoperating conforms to the same WS-I specifications.

D.3 Updates to the Operational Perspective

This section provides details on specific Web services runtime changes between WebSphere Application Server versions 5.0 and 5.1.1. This should allow you to complete the previous Operational Perspective exercises with the new tools. Each subsection will focus on a different aspect of Web services deployment.

D.3.1 Introduction

From a Web services deployment standpoint, very little has changed between the different releases of the application server, and this is a much shorter section than the update to the Development Perspective. Web service-based applications continue to be deployed via J2EE EAR packaging, and the relevant deployment descriptors for the Web services engine are picked up during startup. Here, we will focus primarily on the new WS-Security support and the new Web Services Client Cache.

Significant changes have been made, however, to WebSphere Application Server version 6.0. This new release introduces a number of new technologies, including the Service Integration Bus, which is described in the product documentation as "a highly-flexible messaging system that supports a service-oriented architecture with a wide spectrum of quality of service options, supported protocols, and messaging patterns".[11] A more detailed explanation of its features is out of scope for this update.

D.3.2 Deploying Web Services

Section 5.3 of the Operational Perspective described how to use a number of techniques to deploy the applications created in the Development Perspective to the full WebSphere Application Server clustered environment. The Administration console, `wsadmin` command line tool and ANT tasks remain unchanged between versions 5.0 and 5.1.1.

Readers should be able to complete the deployment section of the Operational Perspective with the new release by following the instructions in the first edition of the book.

[11] The WebSphere Application Server 6.0 Information Center can be found at http://publib.boulder.ibm.com/infocenter/ws60help/index.jsp

D.3.3 Securing a Web Services Implementation (Section 5.4)

Web services security was the topic of Section 5.4 of the Operational Perspective. At the time of writing, transport-layer security (SOAP over HTTPS) was really the only practical choice for organizations wanting to communicate securely, and this still remains a viable option today. However, the launch of WebSphere Application Server version 5.1 saw the first production-ready implementation of the OASIS WS-Security specification in an IBM product.

An important point to note is that not all WS-Security implementations are the same, and most of them are not interoperable at the time of writing. The reason for this, which we explained back in Section 5.4.2 of the first edition of the Operational Perspective, is that WS-Security is an umbrella specification which requires a number of other specifications for its successful implementation. In the case of WebSphere Application Server version 5.1, the following are supported:

- Web Services Security (WS-Security) Version 1.0, 5 April 2002
- Web Services Security Addendum 18 August 2002
- Web Services Security: SOAP Message Security Working Draft 13 May 2003
- Web Services Security: Username Token Working Draft

If you compare this list to Figure 5.9 in the book, then you will see that this is far from complete, and a significant proportion of the documents still have the words 'Draft' or 'Addendum' in their title. The WS-I is currently working on a Basic Security Profile[12], but progress appears to be slow.

There are two places where WS-Security can be configured. The first is in the WebSphere Application Server administration console, and the second is within the JSR 109 client- and server-side deployment descriptor editors in WebSphere Studio. The benefit of this implementation is that none of the security features require any programmatic changes to the service implementation or client - everything is externalized and can be easily modified during deployment. For administrators who do not have (or want) access to WebSphere Studio, IBM provides the Application Server Toolkit (AST) as an optional no-charge feature with the runtime. The AST is a cut-down version of the WebSphere Studio J2EE tools which allow administrators to modify the configuration of applications without having to recompile the application. It is the version 5.x replacement to the tool previously known as the Application Assembly Tool (AAT).

Figure D.18 illustrates the WS-Security options available under the *Security Extensions* tab in the server-side JSR 109 deployment descriptor editor.

[12] You can find the latest draft of the WS-I Basic Security Profile at: http://www.ws-i.org/Profiles/BasicSecurityProfile-1.0.html

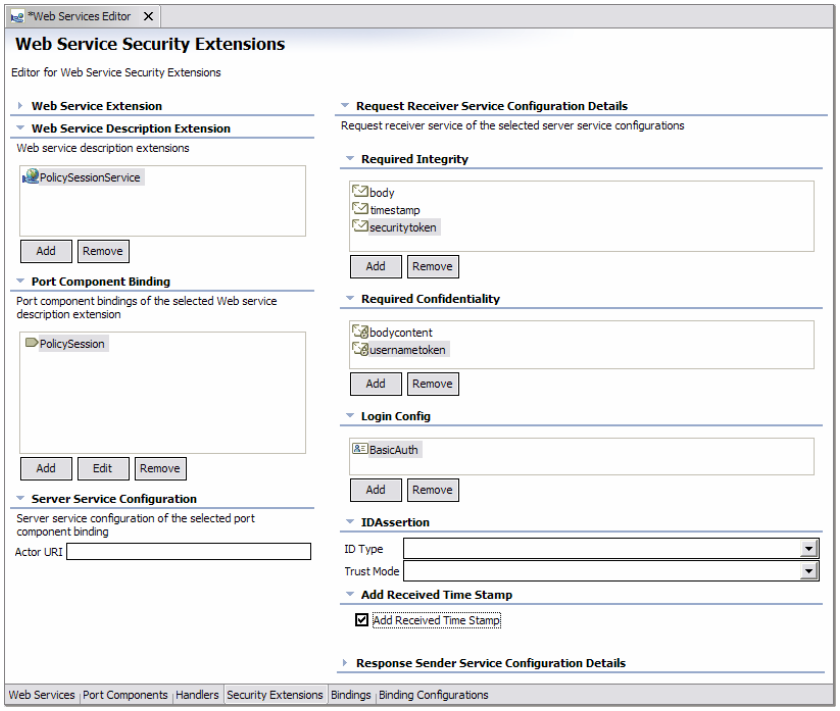

Fig. D.18 WS-Security settings for a WebSphere 5.1 Web service

Configuring WS-Security couldn't be simpler – open the editor and press the *Add* buttons against the required features for either the request receiver or the response sender for each service and binding. A dialog is displayed on each occasion listing the available options. Here's a brief summary of the various terms used for the request, which are described in much more detail in the *WebSphere Application Server -> Securing -> Applications -> Web Services* topic in the WebSphere Studio Help.

Required Integrity — The parts of the message to verify with a digital signature. Options include the body, time the message was sent and the security token sent by the client.

Required Confidentiality — The parts of the request message the server must decrypt. Options include the body of the message and a basic authentication username if used.

Login Config — The mechanism to use when authenticating the request. Options include basic (username/password) authentication, ID assertion (see next definition), X.509 digital certificates or the use of a Lightweight Third Party Authentication (LTPA) token.

ID Assertion — This feature is used if the credentials on the Web service request are to be passed to a downstream Web service. It appends the initial request with an additional Basic Authentication credential trusted by the downstream system.

Received Time Stamp — This option, when used in conjunction with an identical one on the Web service client configuration, ensures message integrity by testing the timeliness of the request. This technique guards against replay attacks.

The editor additionally provides a second tab also relating to the WS-Security configuration, *Binding Configurations*. The features on this page of the editor are shown below in Figure D.19.

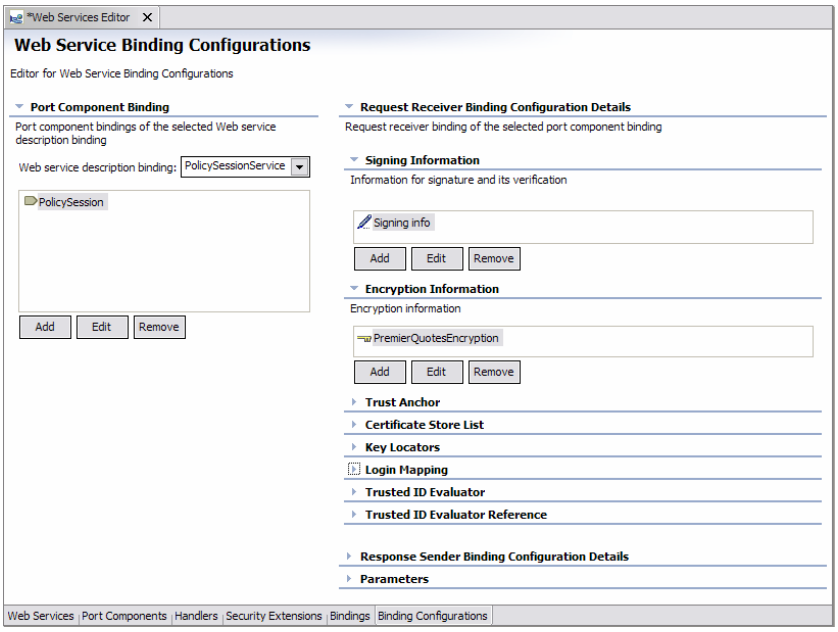

Fig. D.19 WS-Security binding settings for a WebSphere 5.1 Web service

This page also introduces a number of new terms. As before, the configuration may be different for each Web service binding in the application.

Signing Information	Describes the method and algorithm used for digital signature verification. These values must match the values on the client-side deployment descriptor.
Encryption Information	The algorithm used to decrypt an encrypted Web service request. These values must match the values on the client-side deployment descriptor.
Trust Anchor	Defines a key store which contains trusted root certificates which can validate the signer certificate.
Certificate Store	A store containing non-root certificate authority (CA) certificates and certificate revocation lists. These are used to check the signature of a digitally signed Web service request.
Key Locator	Describes the mechanism used to store the keys for digital signature verification and message decryption.
Nonce	A unique cryptographic number embedded in a message to help stop repeat, unauthorized attacks of user name tokens.

The configuration defined in WebSphere Studio is at the application-level. The WebSphere Application Server administration console provides the ability to define default binding values at the server-level. If defined, application-level defaults override any settings made on the server for each application. Figure D.20 below shows the configuration options available under the *Servers -> Application Servers -> Server Name -> Web Services: Default Bindings for Web Services Security* menu.

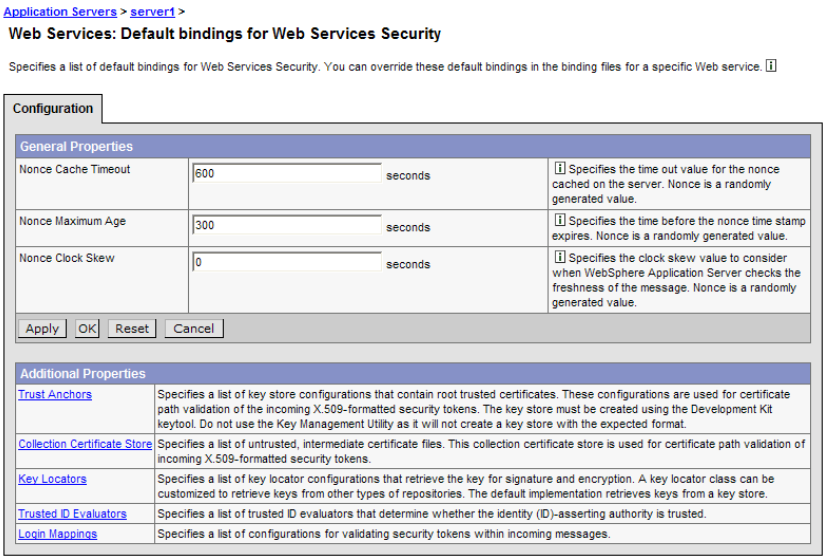

Fig. D.20 Configuring default WS-Security bindings in the WebSphere admin console

We intend to provide a full WS-Security example in the next edition of the book, and hope that this section has provided enough information to let you try out some of the features for yourself until then.

> **WS-Security Verbosity – a Word of Warning**
>
> Although WS-Security sounds like the answer to all security concerns with Web service communications, one issue remains – verbosity. Unfortunately, the comprehensive nature of WS-Security means that it has a significant impact on message size, especially for fine-grained services. For invocations using both digital signatures and encryption, the secure message may be anything between 10 and 20 times the size of the original, unsecured message. For networks with high bandwidth, this is probably not an issue, but for some users it may be enough to justify reverting back to transport-layer security approaches until the specifications have been refactored.

D.3.4 The Web Services Gateway

The final hands-on section in the Operational Perspective, Section 5.5, focused on a technology distributed with the WebSphere Application Server 5.0 runtime – the Web Services Gateway. The feature came under some severe criticism in the book for its poor documentation and unhelpful administration interface, but we have

seen it being used on projects when an intermediary or layer of indirection is required for Web service requests.

New features in the version of the Gateway distributed with WebSphere Application Server 5.1 include:

- Support for the deployment of JAX-RPC handlers onto the gateway in addition to interceptors using the gateway's own filter API
- WS-I Basic Profile compliance and support for document/literal style services
- WS-Security features for both client-to-gateway and gateway-to-service communication
- Provision of two new channel types which support the new IBM JAX-RPC and JSR 109-compliant Web service engine for both SOAP over HTTP and synchronous SOAP over JMS messages
- Significantly improved documentation in the WebSphere Application Server Infocenter

If you are planning to follow the instructions in Section 5.5 of the Operational Perspective to deploy the test services to the Gateway, we now recommend the use of the SOAP over HTTP channel (`wsgwsoaphttp1.ear`) instead of the Apache SOAP channel (`wsgwsoap1.ear`). With this minor change, the instructions in the book should still work with the new release.

D.3.5 Web Services Client Cache

A new feature in WebSphere Application Server version 5.1.1 is the Web Services Client Cache, a significant addition which justifies inclusion into this chapter.

The cache improves the performance of Web service clients running on the application server by caching responses returned by remote Web services. It is provided as a JAX-RPC handler in the application server which intercepts the requests flowing through it and checks against entries in the cache policy to determine if the request is cacheable. If a matching policy is found, it then looks for cache entries matching the request and uses a cached response if previously invoked within the specified invalidation period.

Each Web service must have a unique cache ID rule which may be one of the following:

- A hash of the SOAP envelope
- Specific SOAP header entries
- Specific operation and part parameters
- Custom Java code to build the ID from the SOAP message content

The WebSphere cache policies are defined in a `cachespec.xml` file which is placed in the `WEB-INF` folder of the application's Web module. For more information on the WebSphere Web Services Client Cache, see the *WebSphere Application Server -> Configuring -> Applications -> Application Services -> Configur-*

ing the Web Services Client Cache topic in the WebSphere Application Server Infocenter.

D.3.6 Conclusions

The operational characteristics of Web services in WebSphere Application Server have not changed as significantly as the APIs and standards used in the development environment. The most significant of these is the introduction of WS-Security, although the specification's immaturity, verbosity and lack of interoperability still prevent it from being particularly useful at this time.

D.4 Summary

Although only intended as a brief summary of what's new, we believe this chapter should provide you with enough material to start using the new Web services features of the WebSphere portfolio in conjunction with the first edition of *Perspectives on Web Services*.

D.4.1 Key Messages

In Section D.1 we summarized the major changes to the WebSphere portfolio:

- Version 5.1 saw the introduction of JAX-RPC, JSR 109, WS-Security and WS-I compliance into the products.
- Version 6.0, along with its re-branded Rational Application Developer for WebSphere toolset delivers J2EE 1.4 support, which sees JSR 109 replaced with JSR 921 and the delivery of the Service Integration Bus.
- Deployment of orchestrated business processes in BPEL is now available in WebSphere Business Integration Server Foundation.

Section D.2 described the new Web services features of the WebSphere Studio family:

- All of the Web service wizards now provide support for the JAX-RPC and JSR 109 implementation in WebSphere Application Server 5.1. This should now be used in preference to the older Apache SOAP 2.3 support.
- The tools deliver validation tools for the WS-I Basic Profile version 1.0, and promote the use of document/literal-style Web services over the rpc/encoded-style.
- Integrated editors for the JSR 109 deployment descriptors simplify the creation of JAX-RPC handlers to process SOAP headers.

Finally, Section D.3 outlined the new Web services operational features of WebSphere Application Server 5.1:

- WS-Security configuration is performed through the JSR 109 client- and server-side deployment descriptors, typically using editors in WebSphere Studio or the AST.
- Although comprehensive WS-Security features are available, organizations should still consider transport-layer security approaches if they require secure Web services today. This is especially true for heterogeneous applications or those with extreme non-functional requirements.
- Version 5.1 has also seen some enhancements to the Web Services Gateway and the inclusion of a new Web Services Client Cache into the application server.

D.4.2 Where to Find More Information

As always, http://www.ibm.com/developerworks/webservices, the Web services zone on IBM developerWorks, is an excellent forum with up-to-date information on the wide spectrum of topics covered in this chapter.

For the latest information on WebSphere Application Server versions 5.1.1 and 6.0, browse their Information centers at:
http://www.ibm.com/software/webservers/appserv/was/library/

E Link Reference Update to Initial Publication

The reason for technology moving on in the Web services world sometimes is a response to proceeding insights, possibly resulting in updated or even new specifications and standards. Once the Web services foundation shifts, implementations of runtime and development products must follow. The book's link references to additional information sources have been current at the end of 2003. Not all of these links reflect the actual status any more, though.

This appendix presents a link reference update for all chapters of the book. Each paragraph of the appendix thereby addresses one chapter of the book and contains a table holding changed or additional links relevant to the topic.

References to specifications and standards are typically updated regularly to refer to the current version of these documents, respectively. Older versions are usually archived. Thus, for this type of documents we verified the link and, where appropriate, give information about the archived version initially referenced in the initial publication of the book.

Companies, groups and organizations running Internet sites often rearrange and restructure their Internet appearance. For these types of references we mainly verified the link and just briefly checked, whether the mentioned content or content area is still available at the website.

E.1 Preface

Table E.1 Link reference update for the Preface

Heading: Notational Conventions		
Page	**Book Link**	**Comment**
XV	http://www.springer.de	Link still valid.

E.2 List of Abbreviations

Table E.2 Link reference update for the List of Abbreviations

Heading: List of Abbreviations		
Page	**Book Link**	**Comment**
XXXII	http://whatis.techtarget.com	Link still valid.

E.3 Business Perspective

Table E.3 Link reference update for the Business Perspective

Heading: 1.3.4 Miscellaneous Scenarios		
Page	**Book Link**	**Comment**
20	http://www.oasis-open.org/committees/wsrp	WSRP version 1.0 specification link still valid. WSRP version 2.0 specification currently scheduled for mid 2005.
20	http://www.jxta.org	Link still valid.
Heading: 1.6.2 Where to Find More Information		
Page	**Book Link**	**Comment**
30	http://www.cbdiforum.com	Link still valid.
30	http://www.zapthink.com	Link still valid.
30	http://www.gartner.com	Link still valid.
30	http://www.gigaweb.com	Link still valid.
30	http://www.ibm.com/software/e-business/jstart	Link still valid.
Footnotes		
Page	**Nr.** **Book Link**	**Comment**
16	19 http://www.dnb.com	Link still valid.
19	22 http://www.google.com/apis	Link still valid.

E.4 Training Perspective

Table E.4 Link reference update for the Training Perspective

Heading: 2.3.1 An XML Overview		
Page	**Book Link**	**Comment**
37	http://www.w3.org/TR/REC-xml	Link still valid. However the link now references the Third Edition of the Recommendation: Extensible Markup Language (XML) 1.0 (Third Edition), W3C Recommendation 04 February 2004. The referenced Second Edition is still available at: http://www.w3.org/TR/2000/REC-xml-20001006
40	http://www.w3.org/TR/xml-infoset	Link still valid. However, the link now references the Second Edition of the Recommendation: XML Information Set (Second Edition), W3C Recommendation 04 February 2004. The referenced Edition is still avail-

		able at: http://www.w3.org/TR/2001/REC-xml-infoset-20011024
Heading: 2.3.2 XML Namespaces		
Page	**Book Link**	**Comment**
48	http://www.w3.org/TR/REC-xml-names	Link still valid.
Heading: 2.3.3 XML Schema		
Page	**Book Link**	**Comment**
54	http://www.w3.org/TR/xmlschema-0	Link still valid. However the link now references the Second Edition of the Schema Primer: XML Schema Part 0: Primer Second Edition, W3C Recommendation 28 October 2004. The referenced Edition is still available at: http://www.w3.org/TR/2001/REC-xmlschema-0-20010502
54	http://www.w3.org/TR/xmlschema-1	Link still valid. However the link now references the Second Edition of the Schema Structures: XML Schema Part 1: Structures Second Edition, W3C Recommendation 28 October 2004. The referenced Edition is still available at: http://www.w3.org/TR/2001/REC-xmlschema-1-20010502
54	http://www.w3.org/TR/xmlschema-2	Link still valid. However, the link now references the Second Edition of the Schema Datatypes: XML Schema Part 2: Datatypes Second Edition, W3C Recommendation 28 October 2004. The referenced Edition is still available at: http://www.w3.org/TR/2001/REC-xmlschema-2-20010502
Heading: 2.4 Understanding SOAP		
Page	**Book Link**	**Comment**
76	http://www.w3.org/TR/SOAP	SOAP version 1.1 specification link still valid. However, due to the existence of the new SOAP version 1.2 set of recommendations additional links will be important in the future. SOAP Version 1.2 is available at:

		http://www.w3.org/TR/2003/REC-soap12-part0-20030624 (SOAP Primer), http://www.w3.org/TR/2003/REC-soap12-part1-20030624 (SOAP Messaging Framework), http://www.w3.org/TR/2003/REC-soap12-part2-20030624 (SOAP Adjuncts) and http://www.w3.org/TR/2003/REC-soap12-testcollection-20030624 (SOAP Specification Assertions and Test Collection).
76	http://www.ws-i.org	Link still valid.
76	http://www.ws-i.org/Profiles/Basic/2003-03/BasicProfile-1.0-BdAD.html	The referenced Basic Profile Board Approval Draft version 1.0 of the Basic Profile in the meantime has been moved to archive and is available at http://www.ws-i.org/Profiles/BasicProfile-1.0-2004-04-16.html. The current Basic Profile version 1.1 is available at: http://www.ws-i.org/Profiles/BasicProfile-1.1-2004-08-24.html
Heading: 2.4.1 The SOAP Message Format		
Page	**Book Link**	**Comment**
77	http://schemas.xmlsoap.org/soap/envelope/	Link still valid. However the schema has been produced using W3C's SOAP version 1.2 schema available at: http://www.w3.org/2001/06/soap-envelope
Heading: 2.4.2 The SOAP Section 5 Encoding		
Page	**Book Link**	**Comment**
96	http://schemas.xmlsoap.org/soap/encoding/	Link still valid. However the schema has been produced using W3C's SOAP Version 1.2 schema available at: http://www.w3.org/2001/06/soap-encoding
98	http://msdn.microsoft.com/library/default.asp?url=/library/en-us/dnsoap/html/argsoape.asp	Link still valid.
98	http://www.ibm.com/developerworks/webservices/library/ws-stand2.html?dwzone=webservices	Link still valid.

Heading: 2.5 Understanding WSDL		
Page	**Book Link**	**Comment**
104	http://www.w3.org/TR/wsdl	WSDL version 1.1 specification link still valid. WSDL updates to the W3C Note Version 1.1 initially have been captured under WSDL Working Draft Version 1.2. In November 2003 the version number has been changed to Working Draft Version 2.0. The current set of specifications is available at: http://www.w3.org/TR/2004/WD-wsdl20-20040803/ (WSDL Version 2.0 Part 1: Core Language), http://www.w3.org/TR/2004/WD-wsdl20-extensions-20040803/ (WSDL Version 2.0 Part 2: Predefined Extensions) and http://www.w3.org/TR/2004/WD-wsdl20-bindings-20040803/ (WSDL Version 2.0 Part 3: Bindings)
Heading: 2.6 Understanding UDDI		
Page	**Book Link**	**Comment**
131	http://www.uddi.org/pubs/DataStructure-V2.03-Published-20020719.htm	Link still valid. The complete list of specifications (UDDI version 2 and UDDI version 3) is available at: http://www.uddi.org/specification.html
131	http://www.uddi.org/pubs/ProgrammersAPI-V2.04-Published-20020719.pdf	Link still valid. The complete list of specifications (UDDI version 2 and UDDI version 3) is available at: http://www.uddi.org/specification.html
Heading: 2.6.1 The UDDI Registry Structure		
Page	**Book Link**	**Comment**
134	http://www.dnb.com	Link still valid.
134	http://www.ean-int.org/locations.html	Link still valid.
134	http://www.thomasregister.com	Link still valid.
136	http://eccma.org/unspsc	Link still valid.
136	http://www.census.gov/epcd/www/naics.html	Link still valid.
136	http://www.iso.org/iso/en/prods-services/iso3166ma/index.html	Link still valid.

Heading: 2.6.2 Linking WSDL Documents to a UDDI Registry		
Page	**Book Link**	**Comment**
140	http://www.oasis-open.org/committees/uddi-spec/doc/bp/uddi-spec-tc-bp-using-wsdl-v108-20021110.htm	Link still valid. However, the "Best Practices" document referenced through the link has been complemented with an identically named "Technical Note", offering more flexibility and further integration alternatives. Eventually a "Technical Note" may become a "Best Practices" document and in the present case replace the existing document.
Heading: 2.6.4 Private versus Public UDDI Registries		
Page	**Book Link**	**Comment**
150	http://www.uddi.org/register.html	Link still valid.
Heading: 2.7.2 Where to Find More Information		
Page	**Book Link**	**Comment**
153	http://www.w3.org/TR	Link still valid.
153	http://www.oasis-open.org	Link still valid.
	http://www.oasis-open.org/committees/uddi-spec/doc/tcspecs.htm	Link still valid.
153	http://www.uddi.org	Link still valid.
153	http://www.uddi.org/specification.html	Link still valid.
154	http://www.xml.org	Link still valid.
154	http://www.ibm.com/developerworks/webservices	Link still valid. The link refers to Service-Oriented Architecture (SOA) and Web services tips and articles.
Footnotes		
Page	**Nr.** **Book Link**	**Comment**
131	10 http://www.oasis-open.org	Link still valid.

E.5 Architecture Perspective

Table E.5 Link reference update for the Architecture Perspective

Heading: 3.2.2 Introduction to the W3C Web Services Architecture		
Page	**Book Link**	**Comment**
160	http://www.w3.org/TR/2002/WD-ws-arch-20021114	Link still valid. However, the current version of the document now is in "Working Group Note" status available at: http://www.w3.org/TR/ws-arch/. Also, a couple of complementing documents exist: http://www.w3.org/TR/2004/NOTE-ws-arch-scenarios-20040211/ (Web services architecture use cases

		and usage scenarios), http://www.w3.org/TR/2004/NOTE-wsa-reqs-20040211/ (Web services architecture requirements), http://www.w3.org/TR/2004/NOTE-wslc-20040211/ (Web services management, service lifecycle) and http://www.w3.org/TR/2004/NOTE-ws-gloss-20040211/ (Web services glossary).
Heading: 3.2.3 Service-Oriented Architecture and Java		
Page	**Book Link**	**Comment**
168	http://www.ibm.com/developerworks/oss	Link still valid (check list box "`Open Source Projects`").
168	http://ws.apache.org/wsil	Link not valid any more. The referred Java classes are accessible through http://java-source.net/open-source/web-services-tools/wsil4j at http://cvs.apache.org/viewcvs/*checkout*/ws-wsil/java/README.htm
168	http://ws.apache.org/wsif	Link still valid.
172	http://java.sun.com/j2ee	Link still valid.
Heading: 3.3.1 Web Services Principles and Patterns		
Page	**Book Link**	**Comment**
175	http://xml.apache.org/cocoon	Link still valid.
Heading: 3.3.2 Business Patterns		
Page	**Book Link**	**Comment**
180	http://www.ibm.com/developerworks/patterns/guidelines/web-services.pdf	Link still valid.
Heading: 3.4.2 Service Messaging: SOAP		
Page	**Book Link**	**Comment**
192	http://ws.apache.org/soap	Link still valid (Apache SOAP supports most of SOAP specification version 1.1 features).
192	http://ws.apache.org/axis	Link still valid (Apache Axis).
192	http://www.themindelectric.com/glue/index.html	Link still valid.
192	http://www.ibm.com/software/integration/wmq	Link still valid.
192	http://www.sonicsoftware.com/products/sonicmq/index.ssp	Link still valid. Information about SonicMQ available at: http://www.sonicsoftware.com/products/sonicmq/index.ssp
192	http://www.swiftmq.org	Link still valid.
195	http://www.gzip.org	Link still valid.
195	http://www.gzip.org/zlib	Link still valid.
195	http://www.research.att.com/sw/tools/xmill	Link still valid.

196	http://java.sun.com/xml/downloads/jaxrpc.html	Link still valid for access to JAX-RPC specification version 1.1, version 2.0 and previous versions.
196	http://java.sun.com/xml/jaxm/index.html	Link still valid for access to JAXM specification version 1.1, version 1.1.2 and previous versions.
196	http://java.sun.com/xml/saaj	Link still valid for access to SAAJ specification version 1.2 and previous versions.
196	http://xml.apache.org/axis	Link still valid.
196	http://xml.apache.org/soap	Link still valid.
Heading: 3.4.3 Service Matchmaking: UDDI and WSIL		
Page	**Book Link**	**Comment**
197	http://www.ibm.com/software/websphere	Link still valid.
197	http://developer.novell.com/uddi	Link still valid.
Heading: 3.5.1 Performance		
Page	**Book Link**	**Comment**
207	http://www.ibm.com/developerworks/library/soapenc	Link not valid any more. Various regularly updated information sources about SOAP messaging performance are for example available at: http://www.ibm.com/developerworks/library (search for "`SOAP performance`" or "`SOAP messaging performance`").
Heading: 3.6.1 The XML Language Binding and Encoding Maze		
Page	**Book Link**	**Comment**
215	http://msdn.microsoft.com/library/default.asp?url=/library/en-us/dnsoap/html/argsoape.asp	Link still valid.
215	http://www.ibm.com/developerworks/webservices/library/ws-stand2.html	Link still valid.
218	http://www.castor.org	Link still valid.
218	http://java.sun.com/xml/jaxb/index.html	Link still valid for access to JAXB specification version 1.0.
219	http://www.ibm.com/developerworks/library/x-databdopt	Link still valid.
Heading: 3.6.2 Security		
Page	**Book Link**	**Comment**
224	http://www.projectliberty.org	Link still valid.
225	http://www.w3.org/TR/xmldsig-core	Link still valid for access to the XML-Signature Syntax and Processing W3C Recommendation 12 February 2002.
225	http://www.ietf.org/rfc/rfc3275.txt	Link still valid.
225	http://www.w3.org/TR/xmlenc-core	Link still valid for access to the XML

		Encryption syntax and Processing W3C Recommendation 10 December 2002.
225	http://www.oasis-open.org/committees/security	Link still valid for access to the SAML version 2.0, SAML version 1.1 and SAML version 1.0 specification sets.
225	http://www.oasis-open.org/committees/wss	Link still valid.
225	http://www.ibm.com/developerworks/library/ws-secmap	Link still valid.
225	http://www.ibm.com/developerworks/webservices/library/ws-secure	Link still valid.
225	http://www.ibm.com/developerworks/webservices/library/ws-sec1.html	Link still valid.
Heading: 3.6.3 Web Services Management		
Page	**Book Link**	**Comment**
227	http://java.sun.com/products/JavaManagement/index.html	Link still valid.
227	http://www.amberpoint.com	Link still valid.
227	http://www.talkingblocks.com	Link still valid. However, the link is now redirected to the HP website. Further information about Web services management is available at: http://devresource.hp.com/drc/technical_white_papers/WSMrequirements.jsp and http://devresource.hp.com/technical_white_papers/WSMrequirements.pdf
228	http://www.alphaworks.ibm.com	Link still valid. Access to Web services hosting technology is available at: http://www.alphaworks.ibm.com/tech/wsht
228	http://www.ivs.tu-berlin.de/Projekte/MAQS/index_en.html	Link still valid.
228	http://www.dotqos.org	The DotQoS project has come to an end, the link now refers to a page holding downloads and pointing to ongoing related projects. Further information about the DotQoS project is for example available at: http://www.betriebssysteme.org/download/p2_ulbrich.pdf or http://link.springer.de/link/service/s

		eries/0558/bibs/2707/27070363.htm
228	http://www.alphaworks.ibm.com/tech/ettk	Link still valid.
Heading: 3.6.4 Transactional and Context Semantics		
Page	**Book Link**	**Comment**
229	http://www-.ibm.com/developerworks/library/ws-coor	Link does not work. The formerly correct link http://www.ibm.com/developerworks/library/ws-coor to WS-Coordination is now redirected to http://www.ibm.com/developerworks/library/specification/ws-tx/.
229	http://www.ibm.com/developerworks/library/transpec	Link is not valid any more. WS-Transaction is now named WS-AtomicTransaction and WS-BusinessActivity also available at: http://www.ibm.com/developerworks/library/specification/ws-tx/.
Heading: 3.6.5 Process Orchestration and Workflow		
Page	**Book Link**	**Comment**
230	http://www.ibm.com/developerworks/library/ws-bpel	Link still valid. In 2003 the BPEL4WS specification (defined by IBM, Microsoft, BEA and SAP) has been transferred to OASIS for specification, where it is maintained under the term Web Services Business Process Execution Language (WSBPEL) and available at: http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wsbpel
230	http://www.w3c.org/2002/ws/chor	Link still valid. It refers to page owned by the WS-Choreography Working Group providing access to the member list, meeting minutes and published documents.
Heading: 3.7 Frequently Asked Questions		
Page	**Book Link**	**Comment**
234	http://www.w3.org/TR/SOAP-attachments	SOAP specification version 1.1 link still valid.
234	http://www.w3.org/TR/soap12-af	Link still valid. However, the link now refers to the SOAP 1.2 Attachment Feature W3C Working Group Note 8 June 2004.
234	http://www.ietf.org/rfc	Link still valid.
235	http://www.ws-i.org	Link still valid.
235	http://www.whitemesa.com/interop.htm	Link still valid.
235	http://soapinterop.java.sun.com/soa	Link not valid any more.

	pbuilders/index.shtml	
236	http://www.osgi.org	Link still valid.
236	http://ksoap.enhydra.org	Link still valid. The link provides access to kSOAP version 1.0, kSOAP version 1.1 and a test release of kSOAP version 2.0.
236	http://www.alphaworks.ibm.com/tech/wstkmd	Link still valid.
236	http://www.ibm.com/developerworks/webservices/library/ws-rm	Link still valid.
236	http://www.ibm.com/developerworks/library/ws-add	Link still valid, redirected to: http://www.ibm.com/developerworks/library/specification/ws-add/
Heading: 3.8.1 Key Messages		
Page	**Book Link**	**Comment**
239	http://www.ibm.com/developerworks/webservices/library/ws-spec.html	Link still valid.
Heading: 3.8.2 Where to Find More Information		
Page	**Book Link**	**Comment**
240	http://www.w3c.org	Link still valid.
240	http://www.cbdi.org	This link still exists, but does not refer to the CBDI Forum any more. Please go to http://www.cbdiforum.com instead.
240	http://www.ibm.com/developerWorks/patterns	Link still valid.
240	http://www.jcp.org/en/jsr/all	Link still valid.
240	www.webservicesarchitect.com	Link still valid, go to: http://www.webservicesarchitect.com/
240	www.webservices.org	Link still valid, go to: http://www.webservices.org/
Footnotes		
Page	**Nr.**	**Book Link**	**Comment**
160	7	http://www.w3.org/Consortium/Legal/2002/copyright-documents-20021231	Link still valid.
161	8	http://www.jeckle.de/webServices/index.html	Link still valid.
184	30	http://aosd.net	Link still valid.
186	31	http://www.rosettanet.org	Link still valid.
186	31	http://www.ebxml.org	Link still valid.
190	37	http://www.rational.com	Link still valid, redirected to: http://www.ibm.com/software/rational/. The referred articles TP031 and TP033 are not accessible through an English language website any more, though. An article of Jim Conallen related to developing Web Services ap-

			plications is accessible at: http://www.ibm.com/developerworks/rational/library/569.html
194	41	http://www.castor.org	Link still valid.
211	60	http://www.ecma-international.org	Link still valid.
215	66	http://schemas.xmlsoap.org/soap/encoding	Link still valid, however the schema has been produced using W3C's SOAP Version 1.2 schema available at: http://www.w3.org/2001/06/soap-encoding
224	71	http://www.alphaworks.ibm.com/tech/xmlsecuritysuite	Link still valid.
224	72	http://www.w3.org/TR/xkms2	Link still valid. However, the link now refers to the XML Key Management Specification (XKMS 2.0) Version 2.0 W3C Candidate Recommendation 5 April 2004.

E.6 Development Perspective

Table E.6 Link reference update for the Development Perspective

Heading: 4.1 A Developer's View		
Page	**Book Link**	**Comment**
243	http://www.springer.de/cgi/svcat/bag_generate.pl?ISBN=3-540-00914-0	Link still valid.
Heading: 4.3.4 Configuring the Sample Application		
Page	**Book Link**	**Comment**
267	http://www.springer.de/cgi/svcat/bag_generate.pl?ISBN=3-540-00914-0	Link still valid.
Heading: 4.17.2 Where to Find More Information		
Page	**Book Link**	**Comment**
430	http://www.ibm.com/developerworks	Link still valid.
430	news.software.ibm.com	Server reference still valid. For more information go to: http://news.software.ibm.com/
431	http://developer.java.sun.com/developer	Link still valid.
431	http://marc.theaimsgroup.com	Link still valid.
431	http://groups.google.com	Link still valid.
Footnotes		
Page	**Nr.**	**Book Link**	**Comment**
245	3	http://www.eclipse.org	Link still valid.
246	5	http://eclipse-plugins.2y.net	Link still valid.

246	6	http://www.software.ibm.com/wsdd/downloads/plugin	Link still valid, redirected to: http://www.ibm.com/developerworks/websphere/downloads/plugin/
248	10	http://www.ibm.com/developerworks/webservices/wsdk	The WSDK is no longer available for download. The link refers to an information page indicating that functionality of the WSDK has been incorporated into the IBM WebSphere Studio product family. Further information about these products is accessible at: http://www.ibm.com/developerworks/websphere/zones/webservices/. Product download for evaluation purposes (the Software Evaluation Kit, SEK) is possible through: http://www.ibm.com/developerworks/offers/sek/.
249	11	http://www.alphaworks.ibm.com/tech/ettk	Link still valid.
253	13	http://java.sun.com/xml/jaxrpc/	Link still valid.
257	15	http://www.ibm.com/developerworks/offers/ws-speed-start/wsdk.html	Link still valid.
258	16	http://www.software.ibm.com/wsdd	Link still valid, redirected to: http://www.ibm.com/developerworks/websphere/. Product evaluation download is possible through this page.
393	46	http://www.software.ibm.com/wsdd	Link still valid, redirected to: http://www.ibm.com/developerworks/websphere/. Product evaluation download is possible through this page.
399	49	http://www.w3.org/TR/xpath	Link still valid.

E.7 Operational Perspective

Table E.7 Link reference update for the Operational Perspective

Heading: 5.1 The System Administrator's View		
Page	**Book Link**	**Comment**
434	http://www.springer.de/cgi/svcat/bag_generate.pl?ISBN=3-540-00914-0	Link still valid.
Heading: 5.2 System Architectures for Web Services Solutions		
Page	**Book Link**	**Comment**
435	http://www.ibm.com/developerworks/patterns	Link still valid.

Heading: 5.2.3 Standalone Topology		
Page	**Book Link**	**Comment**
441	http://java.sun.com/j2ee/connector	Link still valid.
441	http://www.sap.com	Link still valid.
Heading: 5.4.3 Securing Web Services with HTTPS and SSL		
Page	**Book Link**	**Comment**
485	http://www.verisign.com	Link still valid.
485	http://www.thawte.com	Link still valid.
485	http://www.ibm.com/developerworks/webservices/library/ws-sec1.html	Link still valid.
486	http://java.sun.com/products/jsse	Link still valid.
486	http://www.redbooks.ibm.com	Link still valid.
493	http://java.sun.com/products/jsse	Link still valid.
Heading: 5.6.2 Where to Find More Information		
Page	**Book Link**	**Comment**
509	http://www.ibm.com/deverlopWorks/webservices	Link still valid, redirected to: http://www.ibm.com/developerworks/webservices
509	http://www.ibm.com/developerworks/patterns	Link still valid.
509	http://www.ibm.com/software	Link still valid.
509	http://www.oasis-open.org	Link still valid.

Footnotes			
Page	**Nr.**	**Book Link**	**Comment**
443	13	http://www.xtradyne.com	Link still valid.
444	14	http://www.ibm.com/software/tivoli/products/access-mgr-e-bus	Link still valid.
444	14	http://www.netegrity.com	Link still valid (Netegrity is a division of Computer Associates).
455	24	http://java.sun.com/products/JavaManagement/	Link still valid.
462	25	http://ant.apache.org	Link still valid.
475	29	http://www.owasp.org	Link still valid.
475	29	http://www.oasis-open.org	Link still valid.

E.8 Engagement Perspective

Table E.8 Link reference update for the Engagement Perspective

Heading: 6.2.2 Step 2: Outline Requirements and High Level Design		
Page	**Book Link**	**Comment**
514	http://xml.org	Link still valid.
514	http://insurance.xml.org	Link still valid.
514	http://www.acord.org/home.aspx	Link still valid.
Heading: 6.3.1 Lessons Learned		
Page	**Book Link**	**Comment**
526	http://www.ws-i.org	Link still valid.

Heading: 6.3.2 Best Practices		
Page	**Book Link**	**Comment**
528	http://www.xmethods.com	Link still valid.
528	http://www.whitemesa.com	Link still valid.
531	http://www.javaperformancetuning.com/tips/webservice.shtml	Link still valid.
531	http://www.ibm.com/developerworks/webservices/library/ws-soapenc	Link still valid.
532	http://uddi.org	Link still valid.
534	http://www.junit.org	Link still valid.
534	http://www.ibm.com/software/e-business/jstart	Link still valid.
534	http://www.ibm.com/developerworks/webservices/library/ws-best1	Link still valid.
Heading: 6.4.2 Where to Find More Information		
Page	**Book Link**	**Comment**
538	http://www.ibm.com/software/e-business/jstart	Link still valid.
538	http://www.ws-i.org	Link still valid.
538	http://www.whitemesa.com	Link still valid.
538	http://www.ibm.com/developerworks/java/library/j-xp1008	Link still valid.
538	http://www.oasis-open.org	Link still valid.
Footnotes		
Page	**Nr.** **Book Link**	**Comment**
526	20 http://java.sun.com	Link still valid.

E.9 Future Perspective

Table E.9 Link reference update for the Future Perspective

Heading: 7.2.1 SOAP Version 1.2		
Page	**Book Link**	**Comment**
540	http://www.w3.org/TR/2002/CR-soap12-part0-20021219	Link still valid. However, the specification is in status W3C Recommendation since June 2003, accessible at: http://www.w3.org/TR/soap12-part0/
540	http://www.w3.org/TR/2002/CR-soap12-part1-20021219/	Link still valid. However, the specification is in status W3C Recommendation since June 2003, accessible at: http://www.w3.org/TR/soap12-part1/
540	http://www.w3.org/TR/2002/CR-soap12-part2-20021219	Link still valid. However, the specification is in status W3C Recommendation since June 2003, accessible at: http://www.w3.org/TR/soap12-part2/

Heading: 7.2.2 WSDL Version 1.2		
Page	**Book Link**	**Comment**
542	http://www.w3.org/2002/ws/desc	Link still valid.
542	http://www.w3.org/TR/2003/WD-wsdl12-20030303	Link still valid. However, the specification has been updated to version number 2.0 in November 2003. The current version is available at: http://www.w3.org/TR/wsdl20/
542	http://www.w3.org/TR/2003/WD-wsdl12-bindings-20030124	Link still valid. However, the specification has been updated to version number 2.0 in November 2003. The current version is available at: http://www.w3.org/TR/wsdl20-bindings/
543	http://www.w3.org/2002/ws/desc/wsdl12-primer	The link is redirected to the current version of the primer at: http://www.w3.org/TR/wsdl20-primer/
543	http://www.w3.org/2002/ws/desc/wsdl12-patterns	The link is redirected to the CVS log for 2002/ws/desc/wsdl20/Attic/wsdl20-patterns.html, where document revisions can be downloaded. The topic is now captured in the Web Services Description Language (WSDL) Version 2.0 Part 2: Predefined Extensions document, available at: http://www.w3.org/TR/wsdl20-extensions/
Heading: 7.2.3 UDDI Version 3.0		
Page	**Book Link**	**Comment**
543	http://www.uddi.org/pubs/uddi-v3.00-published-20020719.htm	Link still valid. However, the current version of the document is in Draft status and available at: http://uddi.org/pubs/uddi_v3.htm
543	http://uddi.org/pubs/uddi_v3_features.htm	Link still valid.
Heading: 7.2.4 J2EE and Web Services		
Page	**Book Link**	**Comment**
545	http://java.sun.com/webservices	Link still valid.
545	http://java.sun.com/j2ee	Link still valid.
545	http://java.sun.com/products/ejb	Link still valid. The EJB 3.0 specification is in early draft status available at: http://java.sun.com/products/ejb/docs.html
546	http://www.jcp.org	Link still valid.
Heading: 7.2.5 Business Process Execution Language for Web Services		
Page	**Book Link**	**Comment**

546	http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wsbpel	Link still valid.
Heading: 7.2.6 Other Specification Work		
Page	**Book Link**	**Comment**
547	http://www.w3c.org	Link still valid.
547	http://www.oasis-open.org	Link still valid.
547	http://www.dmtf.org	Link still valid.
547	http://www.ibm.com/developerworks/webservices/library/ws-spec.html	Link still valid.
Heading: 7.3.6 Summary and Outlook		
Page	**Book Link**	**Comment**
553	http://www.ggf.org	Link still valid.
553	http://www.ggf.org/ogsa-wg	Link not valid any more. Information about the Open Grid Services Architecture Platform and other topics is accessible at: http://www.ggf.org/documents/ or http://www.globus.org/ogsa/
553	http://www.globus.org	Link still valid.
553	http://www.globus.org/research/papers/ogsa.pdf	Link still valid (see also http://www.globus.org/ogsa/)
553	http://www.ibm.com/developerworks/grid	Link still valid.
Heading: 7.4.5 Where to Find More Information		
Page	**Book Link**	**Comment**
560	http://www.w3c.org/2001/sw	Link still valid.
560	http://www.semanticweb.org	At the time of updating the link references this website was going to be relaunched. The site of the relaunch project is available at: http://labs.semanticweb.org/relaunch2004-home. The site referenced in the initial publication is still accessible at: http://www.semanticweb.org/index_old.html
560	http://www.ebxml.org	Link still valid. See also: http://www.ebxmlforum.org/, http://www.ibm.com/developerworks/xml/library/x-ebxml/ or http://xml.coverpages.org/ebXML.html
560	http://www.rosettanet.org	Link still valid.

Heading: 7.5.2 Coming Up		
Page	**Book Link**	**Comment**
564	http://www.cbdiforum.com	Link still valid.
Heading: 7.5.4 Where to Find More Information		
Page	**Book Link**	**Comment**
566	http://www.springer.de	Link still valid.
566	http://www.springer-ny.com	The Springer website for North and South America is still valid.
566	http://www.springer.de/cgi/svcat/bag_generate.pl?ISBN=3-540-00914-0	Link still valid.
566	http://www.premierquotes.com	This link refers to an insurance site currently that was under construction at the time the link reference update has been carried through. The initially referenced site is available at: http://www.perspectivesonwebservices.de
Footnotes		
Page	**Nr.**	**Book Link**	**Comment**
555	6	http://www.w3.org/Consortium/Legal/2002/copyright-documents-20021231	Link still valid.
557	8	http://www.w3.org/Consortium/Legal/2002/copyright-documents-20021231	Link still valid.

E.10 Appendix A

Table E.10 Link reference update for Appendix A

Footnotes			
Page	**Nr.**	**Book Link**	**Comment**
572	1	http://www.omg.org/technology/documents/formal/xmi.htm	Link still valid.

E.11 Appendix C#

Table E.11 Link reference update for Appendix C#

Footnotes			
Page	**Nr.**	**Book Link**	**Comment**
615	1	http://msdn.microsoft.com/netframework/default.aspx	Link still valid.
615	2	http://msdn.microsoft.com/vstudio/default.aspx	Link still valid.
615	3	http://www.icsharpcode.net	Link still valid.

615	3	http://www.improve-technolo-gies.com/alpha/esharp	Link still valid.

E.12 Sources of Information (Top Ten List)

Table E.12 Link reference update for the Sources of Information (Top Ten List)

Heading: Sources of Information		
Page	**Book Link**	**Comment**
627	http://www.ibm.com/deverlopWorks/webservices	Link still valid.
627	http://www.redbooks.ibm.com	Link still valid.
627	http://www.w3c.org	Link still valid.
627	http://www.oasis-open.org	Link still valid.
627	http://xml.apache.org	Link still valid.
627	http://java.sun.com	Link still valid.
627	http://www.ibm.com/software	Link still valid.
627	http://www.ibm.com/software/ebusiness/jstart	Link still valid, similar to: http://www.ibm.com/software/e-business/jstart
627	http://www.alphaworks.ibm.com	Link still valid.
627	http://www.cbdiforum.com	Link still valid.
627	http://www.globus.org/ogsa	Link still valid.
627	http://www.springer.de/cgi/svcat/bag_generate.pl?ISBN=3-540-00914-0	Link still valid.
627	http://www.premierquotes.com	This link refers to an insurance site currently that was under construction at the time the link reference update has been carried through. The initially referenced site is available at: http://www.perspectivesonwebservices.de

E.13 References

Table E.13 Link reference update for the References

References			
Page	**Nr.**	**Book Link**	**Comment**
629	1	http://www.webservicesarchitect.com/content/articles/apshankar04.asp	Link still valid.
629	2	http://www.ibm.com/developerworks/webservices/library/ws-secure	Link still valid.
629	3	http://www.ws-i.org/Profiles/Basic/2003-	The referenced Basic Profile Board Approval Draft version 1.0 of the Ba-

		03/BasicProfile-1.0-BdAD.html	sic Profile in the meantime has been moved to archive and is available at http://www.ws-i.org/Profiles/BasicProfile-1.0-2004-04-16.html. The current Basic Profile version 1.1 is available at: http://www.ws-i.org/Profiles/BasicProfile-1.1-2004-08-24.html
629	4	http://www.w3.org/TR/SOAP-attachments	SOAP specification version 1.1 link still valid.
629	6	http://uddi.org/pubs/uddi-v3.00-published-20020719.htm	Link still valid. However, the current version of the document is in Draft status and available at: http://uddi.org/pubs/uddi_v3.htm
629	7	http://www.sciam.com/article.cfm?articleID=00048144-10D2-1C70-84A9809EC588EF21	Link still valid as an entry point to the entire article.
629	8	http://www.w3.org/TR/xmlschema-2	Link still valid. However, the link now references the Second Edition of the Schema Datatypes: XML Schema Part 2: Datatypes Second Edition, W3C Recommendation 28 October 2004. The referenced Edition is still available at: http://www.w3.org/TR/2001/REC-xmlschema-2-20010502
630	10	http://www.ietf.org/rfc/rfc1521.txt?number=1521	Link still valid.
630	11	http://www.ibm.com/developerworks/webservices/library/ws-polfram	The link is redirected to: http://www-106.ibm.com/developerworks/library/specification/ws-polfram/. This page is an entry point to the WS-Policy Framework specification and articles. The current version of the specification is accessible at: ftp://www6.software.ibm.com/software/developer/library/ws-policy.pdf. Previous versions of the specification are available at: ftp://www6.software.ibm.com/software/developer/library/ws-policy2003.pdf.
630	12	http://www.ibm.com/developerworks/webservices/library/ws-polatt	The link is redirected to: http://www.ibm.com/developerworks/library/specification/ws-polatt/. This page is an entry point to the WS-Policy Attachment specification. The

			current version of the specification is accessible at: ftp://www6.software.ibm.com/software/developer/library/ws-polat.pdf. Previous versions of the specification are available at: ftp://www6.software.ibm.com/software/developer/library/ws-polat2003.pdf.
630	13	http://www.w3.org/TR/SOAP	SOAP version 1.1 specification link still valid. However, due to the existence of the new SOAP version 1.2 set of recommendations additional links will be important in the future. SOAP Version 1.2 is available at: http://www.w3.org/TR/2003/REC-soap12-part0-20030624 (SOAP Primer), http://www.w3.org/TR/2003/REC-soap12-part1-20030624 (SOAP Messaging Framework), http://www.w3.org/TR/2003/REC-soap12-part2-20030624 (SOAP Adjuncts) and http://www.w3.org/TR/2003/REC-soap12-testcollection-20030624 (SOAP Specification Assertions and Test Collection).
630	14	http://www.ibm.com/developerworks/webservices/library/ws-polas	Link still valid.
630	15	http://www.w3.org/TR/REC-xml-names	Link still valid.
630	16	http://www.w3.org/TR/REC-xml	Link still valid. However the link now references the Third Edition of the Recommendation: Extensible Markup Language (XML) 1.0 (Third Edition), W3C Recommendation 04 February 2004. The referenced Second Edition is still available at: http://www.w3.org/TR/2000/REC-xml-20001006
631	18	http://www.w3.org/TR/2002/WD-ws-arch-20021114/	Link still valid. However, the current version of the document now is in "Working Group Note" status available at: http://www.w3.org/TR/ws-arch/. Also, a couple of complementing documents exist:

			http://www.w3.org/TR/2004/NOTE-ws-arch-scenarios-20040211/ (Web services architecture use cases and usage scenarios), http://www.w3.org/TR/2004/NOTE-wsa-reqs-20040211/ (Web services architecture requirements), http://www.w3.org/TR/2004/NOTE-wslc-20040211/ (Web services management, service lifecycle) and http://www.w3.org/TR/2004/NOTE-ws-gloss-20040211/ (Web services glossary).
631	19	http://msdn.microsoft.com/msdnmag/issues/03/04/WS-Security/default.aspx	Link still valid.
631	20	http://www.w3.org/TR/2003/WD-wsdl12-20030303	Link still valid. However, the specification has been updated to version number 2.0 in November 2003. The current version is available at: http://www.w3.org/TR/wsdl20/
631	21	http://www.w3.org/TR/wsdl	WSDL version 1.1 specification link still valid. WSDL updates to the W3C Note Version 1.1 initially have been captured under WSDL Working Draft Version 1.2. In November 2003 the version number has been changed to Working Draft Version 2.0. The current set of specifications is available at: http://www.w3.org/TR/2004/WD-wsdl20-20040803/ (WSDL Version 2.0 Part 1: Core Language), http://www.w3.org/TR/2004/WD-wsdl20-extensions-20040803/ (WSDL Version 2.0 Part 2: Predefined Extensions) and http://www.w3.org/TR/2004/WD-wsdl20-bindings-20040803/ (WSDL Version 2.0 Part 3: Bindings)
631	22	http://www.oasis-open.org/committees/uddi-spec/doc/bp/uddi-spec-tc-bp-using-wsdl-v108-20021110.htm	Link still valid. However, the "Best Practices" document referenced through the link has been complemented with an identically named "Technical Note", offering more flexibility and further integration alternatives. Eventually a "Technical Note" may become a "Best Practices" document and in the present case replace the existing document.

631	23	http://www.xrml.org	Link still valid.
631	24	http://www.xrml.org	Link still valid.
631	25	http://www.xrml.org	Link still valid.
631	26	http://www.xrml.org	Link still valid.
632	27	http://www.xrml.org	Link still valid.
632	28	http://www.xrml.org	Link still valid.
632	29	http://www.w3.org/TR/xml-infoset	Link still valid. However, the link now references the Second Edition of the Recommendation: XML Information Set (Second Edition), W3C Recommendation 04 February 2004. The referenced Edition is still available at: http://www.w3.org/TR/2001/REC-xml-infoset-20011024
632	30	http://www.ibm.com/developerworks/webservices/library/ws-secon	The link is redirected to: http://www.ibm.com/developerworks/library/specification/ws-secon/. This page is an entry point to the WS Secure Conversation Language specification. The current version of the specification is accessible at: ftp://www6.software.ibm.com/software/developer/library/ws-secureconversation.pdf.
632	31	http://www.ibm.com/developerworks/webservices/library/ws-trust	The link is redirected to: http://www.ibm.com/developerworks/library/specification/ws-trust/. This page is an entry point to the WS Trust Language specification. The current version of the specification is accessible at: ftp://www6.software.ibm.com/software/developer/library/ws-trust.pdf.
632	32	http://www.ibm.com/developerworks/webservices/library/ws-secpol	Link still valid.
632	33	http://www.ibm.com/developerworks/library/ws-secureadd.html	Link still valid.
632	34	http://www.w3.org/TR/xmlenc-core	Link still valid for access to the XML Encryption syntax and Processing W3C Recommendation 10 December 2002.
633	35	http://www.w3.org/TR/xmldsig-core	Link still valid for access to the XML-Signature Syntax and Process-

			ing W3C Recommendation 12 February 2002.
633	36	http://uddi.org/pubs/ProgrammersAPI-V2.04-Published-20020719.pdf	Link still valid. The complete list of specifications (UDDI version 2 and UDDI version 3) is available at: http://www.uddi.org/specification.html
633	37	http://uddi.org/pubs/DataStructure-V2.03-Published-20020719.htm	Link still valid. The complete list of specifications (UDDI version 2 and UDDI version 3) is available at: http://www.uddi.org/specification.html
633	39	http://www.w3.org/TR/xmlschema-0	Link still valid. However the link now references the Second Edition of the Schema Primer: XML Schema Part 0: Primer Second Edition, W3C Recommendation 28 October 2004. The referenced Edition is still available at: http://www.w3.org/TR/2001/REC-xmlschema-0-20010502
633	41	http://www.ietf.org/rfc/rfc2068.txt?number=2068	Link still valid.
633	42	http://www.ietf.org/rfc/rfc2616.txt?number=2616	Link still valid.
634	44	http://www.gridforum.org/ogsi-wg/drafts/ogsa_draft2.9_2002-06-22.pdf	Link not valid any more. Information about the Open Grid Services Architecture and other topics is accessible at: http://www.ggf.org/documents/ or http://www.globus.org/ogsa/
634	50	http://www.w3.org/TR/2002/CR-soap12-part1-20021219	Link still valid. However, the specification is in status W3C Recommendation since June 2003, accessible at: http://www.w3.org/TR/soap12-part1/
634	51	http://www.w3.org/TR/2002/CR-soap12-part2-20021219	Link still valid. However, the specification is in status W3C Recommendation since June 2003, accessible at: http://www.w3.org/TR/soap12-part2/
634	53	http://www.w3.org/TR/2003/WD-xkms2-20030418	Link still valid. However, the link to the current version at http://www.w3.org/TR/xkms2 refers to the XML Key Management Specification (XKMS 2.0) Version 2.0 W3C Candidate Recommendation 5 April 2004.

634	54	http://www.ibm.com/developerworks/library/ws-sectoken.html	Link still valid.
635	56	http://www.oasis-open.org/committees/download.php/1371/oasis-sstc-saml-core-1.0.pdf	Link not valid any more. SAML Version 1.0 is accessible and SAML Version 1.1 is available for download at: http://www.oasis-open.org/specs/.
635	57	http://java.sun.com/products/javabeans/	Link still valid.
635	58	http://www.ibm.com/developerworks/library/ws-secroad	Link still valid.
635	59	http://www.itu.int/ITU-T/publications/recs.html	Link still valid.
635	60	http://uddi.org/pubs/uddi_v3_features.htm	Link still valid.
635	61	http://www.ibm.com/developerworks/webservices/library/ws-secure/	Link still valid.
635	62	http://java.sun.com/xml/jaxm	Link still valid.
635	63	http://java.sun.com/xml/saaj	Link still valid for access to SAAJ specification version 1.2 and previous versions.
635	64	http://www-.ibm.com/developerworks/webservices/library/ws-jsr109-proposed	Link does not work, must be: http://www.ibm.com/developerworks/webservices/library/ws-jsr109-proposed
636	66	http://www.ibm.com/software/solutions/webservices/pdf/WSCA.pdf	Link still valid.
636	67	http://www.w3.org/TR/rdf-primer/	Link still valid. However, the link now refers to the current RDF Primer W3C Recommendation 10 February 2004. The RDF Primer W3C Proposed Recommendation 15 December 2003 is available at http://www.w3.org/TR/2003/PR-rdf-primer-20031215/ and the RDF Primer W3C Working Draft is available at http://www.w3.org/TR/2003/WD-rdf-primer-20031010/.
636	68	http://www.w3.org/TR/owl-features/	Link still valid. However, the link now refers to the current OWL Web Ontology Language Overview W3C Recommendation 10 February 2004. The OWL Web Ontology Language Overview W3C Proposed Recommendation 15 December 2003 is available at

			http://www.w3.org/TR/2003/PR-owl-features-20031215/ and the OWL Web Ontology Language Overview W3C Candidate Recommendation 18 August 2003 is available at http://www.w3.org/TR/2003/CR-owl-features-20030818/.
636	69	http://www.oasis-open.org/committees/download.php/1372/oasis-sstc-saml-bindings-1.0.pdf	Link not valid any more. SAML Version 1.0 is accessible and SAML Version 1.1 is available for download at: http://www.oasis-open.org/specs/.
636	70	http://www.w3.org/TR/2002/CR-soap12-part0-20021219	Link still valid. However, the specification is in status W3C Recommendation since June 2003, accessible at: http://www.w3.org/TR/soap12-part0/
636	72	http://www.w3.org/TR/2003/WD-wsdl12-bindings-20030124	Link still valid. However, the specification has been updated to version number 2.0 in November 2003. The current version is available at: http://www.w3.org/TR/wsdl20-bindings/
636	73	http://www.w3.org/TR/soap12-af/	Link still valid. However, the link now refers to the SOAP 1.2 Attachment Feature W3C Working Group Note 8 June 2004.
637	74	http://www.ibm.com/developerworks/library/ws-dime	Link not valid any more. The specification expired (see http://xml.coverpages.org/dime.html or http://msdn.microsoft.com/library/default.asp?url=/library/en-us/dnglobspec/html/wsmsgspecindex.asp). Access is still possible for example through: http://msdn.microsoft.com/library/en-us/dnglobspec/html/draft-nielsen-dime-02.txt or http://gotdotnet.com/team/xml_wspecs/dime/dime.htm
637	76	http://www.gridforum.org/ogsi-wg/drafts/draft-ggf-ogsi-gridservice-23_2003-02-17.pdf	Link not valid any more. The OGSI specification is for example available at: http://www.globus.org/wsrf/OGSI%20to%20WSRF%201.0.pdf or http://xml.coverpages.org/OGSI-SpecificationV110.pdf
637	78	http://java.sun.com/j2ee	Link still valid.
637	79	http://java.sun.com/j2ee/conne	Link still valid.

		ctor	
637	80	http://java.sun.com/xml/jaxrpc/index.html	Link still valid.
637	81	http://www.w3.org/TR/owl-guide/	Link still valid. However, the link now refers to the current OWL Web Ontology Language Guide W3C Recommendation 10 February 2004. The OWL Web Ontology Language Overview W3C Proposed Recommendation 15 December 2003 is available at http://www.w3.org/TR/2003/PR-owl-guide-20031215/ and the OWL Web Ontology Language Guide W3C Candidate Recommendation 18 August 2003 is available at http://www.w3.org/TR/2003/CR-owl-guide-20030818/.
637	82	http://java.sun.com/products/JavaManagement	Link still valid.
637	83	http://www.ibm.com/developerworks/webservices/library/ws-bpel	Link still valid. In 2003 the BPEL4WS specification (defined by IBM, Microsoft, BEA and SAP) has been transferred to OASIS for specification, where it is maintained under the term Web Services Business Process Execution Language (WSBPEL) and available at: http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wsbpel
637	84	http://www.w3.org/TR/xmlschema-1	Link still valid. However the link now references the Second Edition of the Schema Structures: XML Schema Part 1: Structures Second Edition, W3C Recommendation 28 October 2004. The referenced Edition is still available at: http://www.w3.org/TR/2001/REC-xmlschema-1-20010502

E.14 Copyright Notices

Table E.14 Link reference update for the Copyright Notices

Heading: Copyright Notices		
Page	**Book Link**	**Comment**

641	http://www.w3.org/Consortium/Legal/2002/copyright-documents-20021231	Link still valid.
641	http://www.w3.org/Consortium/Legal/2002/copyright-documents-20021231	Link still valid.