THE ARCHITECTURE FOR DEVELOPMENT OF IBM XML AND WEB SERVICES DEVELOPMENT ENVIRONMENT

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ABSTRACT

This research paper describes the architecture for Web Services from the perspective of components, interactions and application development patterns. This architecture is the blueprint for an IBM instantiation of the Web Services approach. It is a framework for the building and deployment of Web Services applications. The architecture presented in this paper includes abnormal state descriptions of the components and capacities required for Web Services, and requirements on the apparatuses and middle ware to implement these components and capacities. Some functionality exists today in items, for example, the IBM XML and Web Services Development Environment, the IBM Web Services Toolkit and IBM Web Sphere Application Server. These and other items will implement extra capacities in the future. However, the presence of a component, capacity or requirement in this paper does not guarantee that it will be implemented in future IBM items.

INTRODUCTION

Web Services

This section briefly reviews Web Services as an application integration technology, defines the term web service and describes the Web Services model. The Web improved the situation program-to-user interactions; Web Services are poised to improve the situation program-to-program interactions. Web Services enable companies to reduce the cost of doing e-business, to deploy arrangements faster and to open up new opportunities. The key to reaching this new skyline is a common program-to-program communications model, based on existing and emerging standards, for example, HTTP, Extensible Markup Language (XML), Simple Object Access Protocol (SOAP), Web Services Description Language (WSDL) and Universal Description, Discovery and Integration (UDDI).

Web Services enable applications to be integrated more quickly, easily and less expensively than any time in recent Memory. Integration happens at a higher level in the convention stack, based on messages centered more on service semantics and less on network convention semantics, along these lines enabling loose integration of business capacities. These characteristics are ideal for connecting business works over the Web both between enterprises and inside enterprises. They provide a bringing together programming model so application integration inside and outside the enterprise should be possible with a common approach, leveraging a common infrastructure. The integration and application of Web Services should be possible in an incremental manner, utilizing existing languages and stages and by receiving existing legacy applications. Moreover, Web Services compliment Java 2 Platform, Enterprise Edition (J2EE), Common Object Request Broker Architecture (CORBA) and other standards for integration with more firmly coupled distributed and no distributed applications. Web Services are a technology for deploying and giving access to business works over the Web;

J2EE, CORBA and other standards are technologies for implementing Web Services.

Definition of Web Services

A Web service is an interface that describes a collection of operations that are network-accessible through standardized XML messaging. A Web service is described utilizing a standard, formal XML thought, called its service description.

The Web Services Model

The Web Services architecture is based upon the interactions between three roles: service provider, service registry and service requestor. The interactions involve the distribution, find and tie operations. Together, these roles and operations follow up on the Web Services curios: the Web service software module and its description. In a regular scenario, a service provider has a network-accessible software module (an implementation of a Web service). The service provider defines a service description for the Web service and publishes it to a service requestor or service registry. The service requestor uses a discover operation to retrieve the service description locally or from the service registry and uses the service description to tie with the service provider and invoke or interact with the Web service implementation. Service provider and service requestor roles are coherent develops and a service can exhibit characteristics of both. Figure 1 illustrates these operations, the components giving them and their interactions.

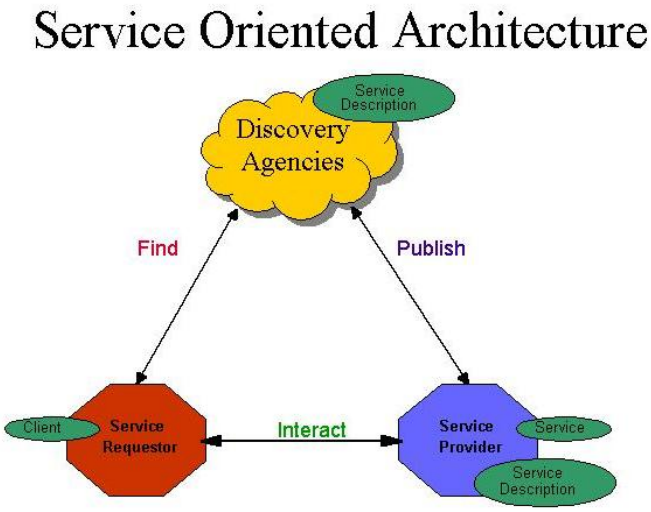

Figure 1 Web Services roles, operations and artifacts

Operations in Web Service Architecture

For an application to take advantage of Web Services, three behaviors must take place: distribution of service descriptions, query or finding of service descriptions, and authoritative or summoning of services based on the service description. These behaviors can happen separately or iteratively. In detail, these operations are:

- Publish. To be accessible, a service description needs to be published with the goal that the service requestor can discover it. Where it is published can differ depending upon the requirements of the application (see "Service Publication" for more details).

- Find. In the discover operation, the service requestor retrieves a service description directly or queries the

- Service registry for the type of service required (see "Service Discovery" for more details). The discover operation can be involved in two different lifecycle phases for the service requestor: at design time to retrieve the service's interface description for program development, and at runtime to retrieve the service's official and area description for conjuring.

- Bind. Eventually, a service needs to be invoked. Stuck the scrape operation the service requestor invokes or initiates an interaction with the service at runtime utilizing the coupling details in the service description to locate, contact and invoke the service.

Web Architecture

We can examine the IBM Web Services architecture in several layers. In the first place, we will take a gander at a conceptual stack for Web Services and the stack details. Then we will examine the criteria for picking the network convention. We will likewise review fundamental XML-based messaging distributed figuring. We extend essential XML messaging with service description, which is explained in terms of a service description stack. Following this, we examine the role of service description in the Web Services architecture, outlining the range of service distribution techniques supporting static and dynamic Web Services applications. Related to service production, we talk about the role of service discovery. At long last, we describe extensions of the fundamental Web Services architecture required to make Web Services viable for e-business.

The Web Services Stack

To perform the three operations of distribute, find and tie in an inter operable manner, there must be a Web Services stack that embraces standards at each level. Figure 2 demonstrates a conceptual Web Services stack. The upper layers expand upon the capabilities provided by the lower layers. The vertical towers represent requirements that must be addressed at every level of the stack. The text on the left represents standard technologies that apply at that layer of the stack.

The Conceptual Web Services Stack

The establishment of the Web Services stack is the network. Web Services must be network-accessible to be invoked by a service requestor. Web Services that are openly available on the Internet use commonly deployed network conventions.

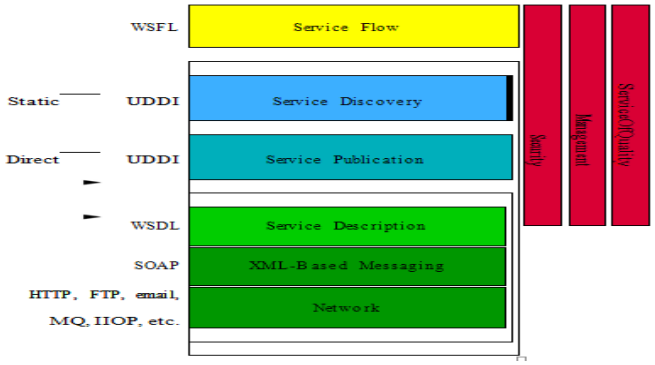

Figure 2 Web Services conceptual stack

The next layer, XML-based messaging, represents the use of XML as the reason for the messaging convention. Cleanser is the chosen XML messaging convention for some reasons:

- It is the standardized enveloping mechanism for conveying document-centric messages and remote procedure calls utilizing XML.
- It is simple; it is essentially a HTTP POST with a XML envelope as payload.
- It is preferred over simple HTTP POST of XML because it defines a standard mechanism to incorporate orthogonal extensions to the message utilizing SOAP headers and a standard encoding of operation or capacity.
- SOAP messages bolster the distribution, find and tie operations in the Web Services architecture. The section "XML Messaging-Based Distributed Computing" describes this layer in more detail.

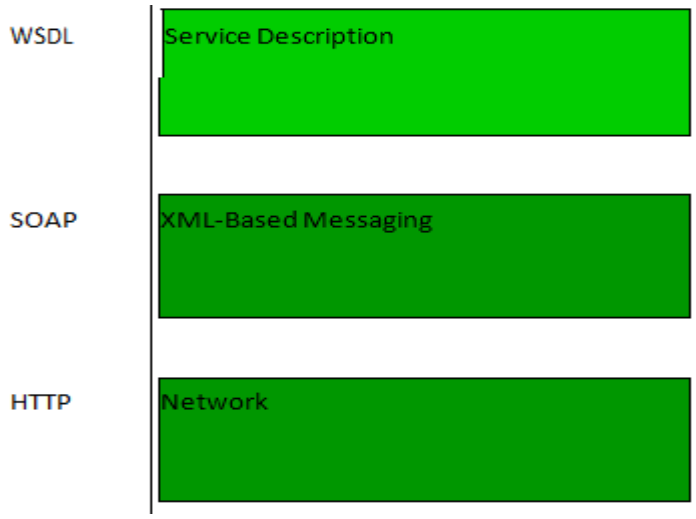

Figure 3 Interoperable base Web Services stack

The stack depicted in Figure 3 provides for interoperability and enables Web Services to leverage the existing Internet infrastructure. This creates an ease of entry to a pervasive environment. Flexibility isn't compromised by the interoperability requirement, because additional help can be provided for alternative and value-include technologies. For example, SOAP over HTTP must be supported, yet SOAP over MQ can be supported also. While the last three layers of the stack identify technologies for compliance and interoperability, the next two layers service production and service discovery can be implemented with a range of arrangements.

The Network

At the base of the Web Services stack is the network. This layer can represent any number of network conventions: HTTP, FTP, SMTP, Message Queuing (MQ), and Remote Method Invocation (RMI) ML Messaging-Based Distributed Computing

The most fundamental underpinnings of the IBM Web Services architecture is XML messaging. The current business standard for XML messaging is SOAP. IBM, Microsoft and others submitted SOAP to the W3C as the premise of the XML Protocol Working Group. The XML convention will replace SOAP as the business standard XML messaging

convention. When the W3C has released a draft standard for the XML convention, the IBM Web Services architecture will migrate from SOAP to the XML convention.

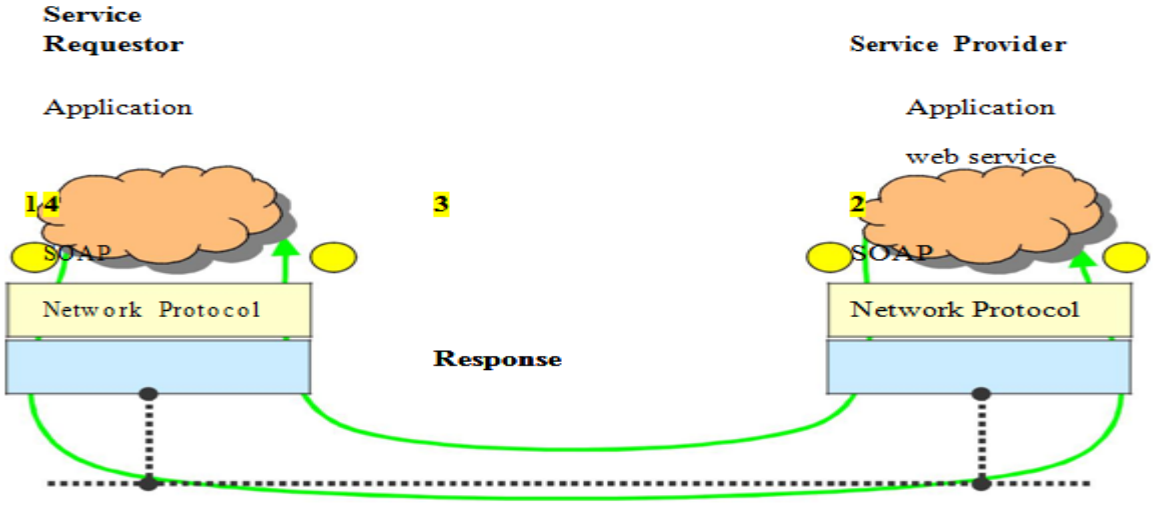

Figure 4 XML messaging using SOAP

The essential requirements for a network node to assume the role of requestor or provider in XML messaging-based distributed registering are the capacity to fabricate, parse a SOAP message, or both, and the capacity to communicate over a network (receive, send messages, or both). Commonly, a SOAP server running in a Web application server performs these capacities. Alternatively, a programming language-specific runtime library can be used that encapsulates these capacities inside an API. Application integration with SOAP can be achieved by utilizing four essential steps:

- In Figure 4, at (1) a service requestor's application creates a SOAP message. This SOAP message is the request that invokes the Web service operation provided by the service provider. The XML document in the body of the message can be a SOAP RPC request or a document-centric message as indicated in the service description. The service requestor presents this message together with the network address of the service provider to the SOAP infrastructure (for example, a SOAP client runtime). The SOAP client runtime interacts with an underlying network convention (for example HTTP) to send the SOAP message out over the network.

- At (2) the network infrastructure delivers the message to the service provider's SOAP runtime (for example a SOAP server). The SOAP server routes the request message to the service provider's Web service. The SOAP runtime is responsible for converting the XML message into programming language-specific objects if required by the application. This conversion is governed by the encoding schemes found inside the message.

- The Web service is responsible for processing the request message and figuring a response. The response is additionally a SOAP message. At (3) the response SOAP message is

- Presented to the SOAP runtime with the service requestor as the destination. On account of synchronous request/response over HTTP, the underlying request/response nature of the networking convention is used to implement the request/response nature of the messaging. The SOAP runtime sends the SOAP message response to the service requestor over the network.

- At (4) the response message is received by the networking infrastructure on the service requestor's node. The message is routed through the SOAP infrastructure; potentially converting the XML message into objects in a target programming language. The response message is then presented to the application.

Service Description: From XML Messaging to Web Services

It is through the service description that the service provider communicates every one of the specifications for conjuring the Web service to the service requestor. The service description is key to making the Web Services architecture loosely coupled and reducing the measure of required shared understanding and custom programming and integration between the service provider and the service requestor. For example, neither the requestor nor the provider must be aware of the other's underlying stage, programming language, or distributed object model (assuming any). The service description combined with the underlying SOAP infrastructure sufficiently encapsulates this detail far from the service requestor's application and the service provider's Web service.

The Complete Web Service Description

The complete Web service description expands on the fundamental WSDL definition of the service. The complete Web service description addresses questions, for example, What business is facilitating this service and what sort of business is it? What items are associated with this service? With what categories in different organization and item taxonomies is this business or its Web service associated? Are there other aspects of the service, (for example, Quality of Service) that can influence whether a requestor would choose to invoke the service? What keywords can be provided with the goal that it is easier to discover this service?

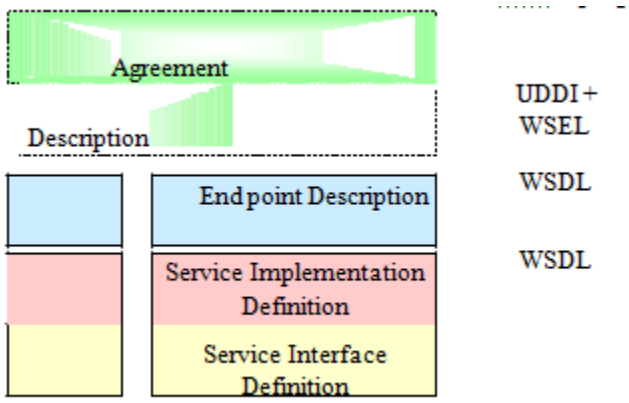

Figure 6 Complete Web Services description stack

UDDI provides a mechanism for holding descriptions of Web Services. In spite of the fact that UDDI is often thought of as a directory mechanism, it likewise defines an information structure standard for A UDDI entry begins with a business Entity. A business Entity element models data about a business, including fundamental business data (for example, What is the business name and contact data?), categorization data (for example, What sort of business is this?), and identifier data (that is, What is the Dunn and Bradstreet number?). A business Entity contains a collection of business Service elements, one for each Web service the business wishes to distribute. Each business Service element contains technical and descriptive data about a business Entity element's Web service. A business Service contains a collection of restricting Template elements. A coupling Template describes the access data (for example, the endpoint address) and describes how the business Service uses different technical specifications. A technical specification is modeled as a t Model. A t Model can model a wide range of concepts, for example, a type of service, a stage technology, for

In the IBM Web Services architecture, the complete Web service description includes a layer for an endpoint description that uses the UDDI entry to add business and implementation context to the service description. The endpoint description takes after the convention proposed by IBM for utilizing UDDI in mix with WSDL. The

Web Services for Real e-business

While SOAP and HTTP are sufficient for interoperable XML messaging, and WSDL is sufficient to communicate what messages are required between service requestor and service provider, more is needed to cover the full range of requirements for e-business. To completely bolster e-business, extensions

representing service description data in XML. There are four fundamental information structures in a UDDI entry, as depicted in Figure 7.

are needed for security, reliable messaging, nature of service, and management for each layer of the Web Services stack. Additional requirements for a Web Services infrastructure include bolster for service context, conversations and activities, intermediaries, entry integration and service stream management.

Security

Is a Web Services security layer really required? The business already has a set of existing and widely accepted transport-layer security mechanisms for message-based architectures, for example, Secure Sockets Layer (SSL) and Internet Protocol Security (IPSec), why include another? To answer that question we will examine the requirements and explore several scenarios in which the security provided by the different existing transport layer security mechanisms alone does not provide adequate security in a Web Services model.

In general, there are four essential security requirements that the Web Services security layer must provide:

- Confidentiality is the property that data isn't made available or disclosed to unauthorized people, entities, or processes, and guarantees that the contents of the message are not disclosed to unauthorized people.

- Authorization is the conceding of expert, which includes the giving of access based on access rights and guarantees that the sender is authorized to send a message.

- Data integrity is the property that information has not been undetectably altered or destroyed in an unauthorized manner or by unauthorized users thereby protecting that the message was not modified accidentally or deliberately in travel.

- Proof of source is evidence identifying the originator of a message or information. It asserts that the message was transmitted by a properly identified sender and isn't a replay of a previously transmitted message. This requirement implies information integrity.

End-to-End Secure transport conventions, for example, SSL and IPSec can provide the integrity and confidentiality of the message amid transmission, however they do as such just for point-to-point. However, because SOAP messages are received and processed by intermediaries, secure end-to-end correspondence isn't possible if there is no put stock in relationship among every one of the intermediaries, even however the correspondence connects between them are trusted. End-to-end security is likewise compromised in the event that one of the correspondence joins isn't secured.

Transport Independence. One of the intended uses of SOAP intermediaries is to forward messages to different networks, often utilizing different transport conventions. Even if all the correspondence joins are secured and the intermediaries can be trusted, security data, for example, the authenticity of the originator of the message needs to be translated to the next security area of the vehicle convention along the message way, which could be tedious and complex, and could lead to integrity defects.

Nature of Service and Reliable Messaging

The Quality of Service vertical tower provides for the specification of data relevant to each of the layers of the Web Services conceptual stack. For the network layer, this would infer being able to use networks of different levels of nature of service.
The need for reliable messaging over the network will drive the choice of network technologies based on their capacity to deliver a high caliber of service in this area. Reliable messaging refers to the capacity of an infrastructure to deliver a message once and just once, to its intended target or to provide a definite event, potentially to the source, if the delivery can't be accomplished. The mix of the network layer and XML messaging should bolster four levels of messaging qualities of service:

1. Best-Effort: The service requestor sends the message, and the service requestor and infrastructure don't attempt retransmissions.

2. At-Least-Once: The service requestor makes a request and retries the request until the point that it receives an acknowledgment. Duplicate message processing by the service provider isn't a problem, for example, simple query processing. In implementation this may mean that each message contains a unique ID. The service requestor retransmits unacknowledged messages at an interval that it decides. A service provider sends an acknowledge message, response messages for a RPC and a can't process message exception in the event that it can't process the request.

3. At-Most-Once: This expands at any rate once scenario. The service

requestor tries the request until the point when it gets a reply. A mechanism like existing universal unique identifiers (UUIDs) enables the service provider to suppress any duplicate requests, guaranteeing the request isn't executed multiple times. For example, a request to take an item from a number in an inventory.

4. Exactly-Once: The service requestor makes a request and is guaranteed by the reply that the request has been executed. The exactly-once mode of interchange eliminates the need to retransmit requests and accommodates failure scenarios.

The endpoint manager participates in nearby exchanges with other resource managers so queuing the message with the endpoint manager and perhaps recording the business process step in a database should be possible in one exchange. The application should delegate the responsibility for delivering messages, or detecting the failure to do as such, to the endpoint manager, which can work at the network transport level or at the XML messaging level.

Systems and Application Management

As Web Services become basic to business operations, management of them will be required. Management in this case means that a management application, either custom worked for the application or purchased from a vendor, can discover the existence, accessibility and health of the Web Services infrastructure, Web Services, service registries and Web service applications. Ideally, the management system ought to likewise be able to control and configure the infrastructure and components.

Service of web services

Intelligent Web Services are generally Web Services whose behavior is consistent with their environment's current state. Ideally, this behavior ought to be self-designing. While it is the responsibility of the Web service provider to code an intelligent application, it is hard to do as such without data about the runtime environment's current state and context. The XML messaging layer needs to define bolster for spreading context data on calls to Web Services. Some examples of context data are The type of wireless device on which the application executes and its Global Positioning System (GPS) coordinates.

- A reference to one or more user profiles that define the user's preferences.

- Current time and condition data from the service requestor's perspective.

The XML messaging layer per se isn't responsible for defining the details or schema of preferences and contexts.

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