Consideration issues of Web Services in IPv6 Environment

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Abstract

The popularity of web services within the IT industry continues to grow as the next generation web technologies. Web services are self-contained, self-describing, modular applications that can be published, located, and invoked across the Web. Web services will be core technology for e-business in the Web.

IPv6 is sometimes also called the Next Generation Internet Protocol and is a new version of IP which is designed to be an evolutionary step from IPv4.

In this paper, we define problems for adapting web services to IPv6 Environment. This paper survey and explain consideration issues that include standards, components, coexistence of IPv6 and IPv4, etc.

***Key Word** : Web Services, IPv6, IPv4/IPv6 Coexistence Network*

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1. Introduction

The popularity of web services within the IT industry continues to grow as the next generation web technologies. The power of Web services, in addition to their great interoperability and extensibility thanks to the use of XML, is that they can then be combined in a loosely coupled way in order to achieve complex operations. Programs providing simple services can interact with each other in order to deliver sophisticated added-value services.

IPv6 will be vital in the near future to make every kind of electronic device connected to the Internet. These devices are, for example, PDA, cellular phones, automobiles, air conditioners, microwave ovens, refrigerators and various kinds of home appliances [5]. As the internet makes the transition from IP version 4 to IP version 6, it will be necessary to allow IPv4-based clients to access IPv6-based servers, and IPv6-based clients to access legacy services.

Therefore, we need to check consideration issues for adapting web services to coexistence network.

In this paper, we survey and explain consideration issues that include standards, components, coexistence of IPv6 and IPv4, etc

2. Related Work

2.1 Web Services

The definition of Web Services from W3C is that 「A Web service is a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards.」

The web services architecture defined by the W3C enables application to application communication over the internet. Web services allow access to software components through standard web technologies, regardless of platforms, implementation languages, etc.

A web services-based architecture contains three functions, as depicted in Figure 1:

- A Web Service Requestor is to find the service description of interest and uses this service description to bind to the web service provided by the web service provider.
- A Web Service Provider is to create a service description, publish that service description to one or more means of discovery, and have the web service ready to receive messages from web service requestor.
- A Web Service Registry is to advertise the web service descriptions published to it by web service providers and to help web service requestors search through its registry to find a service description of interest.

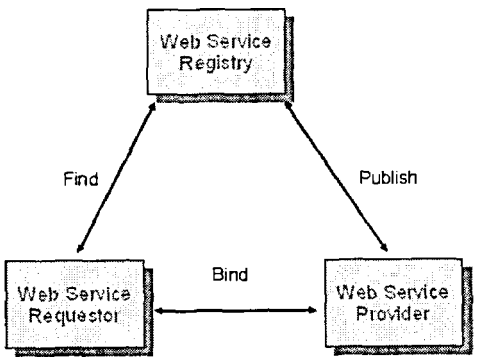

Figure 1. Web services Architecture

The following is the core standards of web services:

- WSDL(Web Services Description Language)) is an XML-based format for specifying the interface to a web service. The WSDL details the service's available methods and parameter types, as well as the actual SOAP endpoint for the service. In essence, WSDL is the "user's manual" for the web service.
- SOAP(Simple Object Access Protocol) is the XML-based protocol for sending requests and responses to and from web services. It consists of three parts: an envelope defining message contents and processing, encoding rules for application-defined data types, and a convention for representing remote procedure calls and responses.
- UDDI(Universal Discovery, Description and Integration) is the meeting place for web services. The UDDI registry stores descriptions about companies and the services they offer in a common XML format. As such, the UDDI is effectively a "yellow pages" for web services.

2.2 IPv6

IPng(the Next Generation Internet Protocol) was recommended by the IPng Area Directors of the Internet Engineering Task Force at the Toronto IETF meeting on July 25, 1994, and documented in RFC 1752, "The Recommendation for the IP Next Generation Protocol" [1]. The recommendation was approved by the Internet Engineering Steering Group on November 17, 1994 and made a Proposed Standard.

The formal name of this protocol is IPv6 (where the "6" refers to it being assigned version number 6). The current version of the Internet Protocol is version 4 (referred to as IPv4). This overview is intended to give the reader an overview of the IPng protocol. For more detailed information the reader should consult the documents listed in the reference section.

IPng is a new version of IP which is designed to be an evolutionary step from IPv4. It is a natural increment to IPv4. It can be installed as a normal software upgrade in internet devices and is interoperable with the current IPv4. Its deployment strategy was designed to not have any "flag" days. IPng is designed to run well on high performance networks (e.g., ATM) and at the same time is still efficient for low bandwidth networks (e.g., wireless). In addition, it provides a platform for new internet functionality that will be required in the near future.

2.3 IPng Transition mechanisms

The IPng transition mechanisms ensures that IPv6 hosts can interoperate with IPv4 hosts

anywhere in the Internet up until the time when IPv4 addresses run out, and allows IPv6 and IPv4 hosts within a limited scope to interoperate indefinitely after that. This feature protects the huge investment users have made in IPv4 and ensures that IPv6 does not render IPv4 obsolete. Hosts that need only a limited connectivity range (e.g., printers) need never be upgraded to IPv6.

3. Consideration Issues

3.1 Format for Literal IPv6 Addresses in URL's(RFC 2732)

Information Model for Endpoint References in Web Services Addressing use URI for identifying the endpoint. URI may be a network address or a logical address.

However, Literal IPv6 addresses are not supported in the Uniform Resource Identifiers (URI): Generic Syntax

Format for Literal IPv6 Addresses in URL's defines the format for literal IPv6 Addresses in URL's for implementation in World Wide Web browsers.

This document updates the generic syntax for Uniform Resource Identifiers defined in RFC 2396. It defines a syntax for IPv6 addresses and allows the use of "[" and "]" within a URI explicitly for this reserved purpose [4].

The example of IPv6 addresses in URL is illustrated as following.

```
http://[::FFFF:129.144.52.38]:80/index.html
http://[2010:836B:4179::836B:4179]
```

3.2 XML (eXtensible Markup Language)

XML is a high level language which is largely IP protocol independent.

3.3 SOAP (Simple Object Access Protocol)

The use of IP addresses in Uniform Resource Identifiers (URIs) should be avoided whenever possible. However, when used, the literal format for IPv6 addresses in URIs as described by RFC 2732 should be supported.

3.4 WSDL (Web Services Description Language)

WSDL defines a common binding mechanism. This is used to attach a specific protocol or data format or structure to an abstract message, operation, or endpoint.

All the IPv6 considerations for SOAP must be extended to WSDL.

3.5 SOAP Routing in Coexistence Network

Routing is a process of delivering messages through a series of nodes or intermediaries. Each intermediary not only provides a message delivery channel, but may also provide value-added services such as logging, auditing and validations. Routing is an essential part of distributed computing, and will play an important rule in multi-party message exchanges.

WS-Routing is a protocol that defines how SOAP messages can be delivered using various transports. Routing information is carried from one intermediary to another inside the SOAP header element. WS-Routing, thus, can be understood as an extension to SOAP

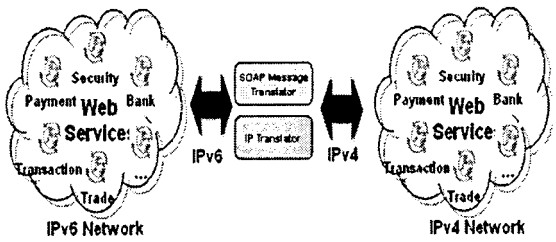

Figure 2. Architecuture for interoperable SOAP messaging in coexistence network

In coexistence environment, we need to consider how can process the IP addresses of SOAP header.

The following is the routing cases in coexistence network.

- *Case 1*: In IPv4 Network

  I) Application in IPv4 → Application in IPv4 → Application in IPv6

  II) Application in IPv4 → Application in IPv6

- *Case 2*: In IPv6 Network

  I) Application in IPv6 → Application in IPv6 → Application in IPv4

  II) Application in IPv6 → Application in IPv4

4. Conclusion

In the coexistence network, Web Services will be next generation integration technology. For example, it can support application integration for devices, wire and wireless network, etc.

In this paper, we survey consideration issues such as Format for Literal IPv6 Addresses in URL's, XML, SOAP, WSDL, SOAP routing in coexistence network.

For Future work, we will develop the IPv6-based web services applications and set up the test-bed.

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