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An Implementation of Metadata Exchange Services for Audio-Visual Contents Using Web Services

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Abstract In the present time, the fusion of the computer world, the communication world and the broadcast world is progressing. In addition, the development of multimedia technology standards and advanced technologies are changing the present audio-visual world (TV beyond TV), that can make various new service models. For example, TV-Anytime Forum is defining service models in which users can explore and acquire TV content distributed over a variety of sources. Moreover, users will be able to create their own digital entertainment packages, exchange and share information among users and redistribute contents among devices, systems or users. To make this real, metadata exchange in distributed environment is a key technology. Besides, Web services seem to have become the next important thing in computing today, because web services are representing an important evolutionary step in building distributed applications . Therefore in this paper, implementation of metadata exchange over IP networks using SOAP and Web Services are described and some experimental results are also mentioned as well as its evaluation.

Keyword Metadata, TV-Anytime, Web Services, SOAP

1. Introduction

The TV-Anytime forum[1] is an organization which develops multimedia service specifications base on high volume digital storage in consumer platforms. TV-Anytime Forum has defined service models , metadata in which users can explore and acquire TV content distributed over a variety of sources. The forum is also defining interface and framework for exchange metadata such as program metadata audio-visual contents description, content referencing information over IP network.

In the present time, the TV-Anytime is in the process of defining a set of web services to be used for interface of metadata exchange service over bi-directional network. There are 3 proposals AN335[2], AN412[3] and AN451[4] that proposed web services[5] for exchanging TV-Anytime metadata over IP networks as a interface. In addition, specification draft SP006v1.0[6] that is proposed for delivery of metadata over a Bi-directional network specification will be completed by the end of this year.

With above as background, the purpose of this paper is in order to evaluate whether the web services can be used efficiently for metadata exchange service based on AN335, AN412 and AN451 proposals in TV-Anytime forum. Experimental results as well as evaluation are described.

2. Metadata Exchange Services Model

The generic metadata exchange service model is depicted in figure 1.

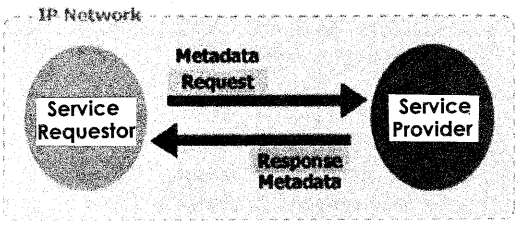

figure 1: generic metadata exchange model

In the model, the processing is clarified as follows:

(1) The metadata service provider utilizes UDDI[7] (Universal Description, Discovery and Integration) to registering the service for client to discover the service anywhere on the Internet. UDDI also assist client in finding WSDL[8] (Web Service Description Language) file.

(2) The metadata service provider uses WSDL for describing function and interface of their own service. WSDL also provides you with automatically genereated client proxy stubs to access them. When clients found the metadata service, they will access to WSDL file for binding the service and request to the service for retrieving or exchange metadata.

(3) SOAP[9] is used as a protocol for delivering metadata. There are 2 styles for using SOAP-based system, SOAP-RPC and SOAP messaging. The first, SOAP-RPC, lets you invoke remote applications independent of platform and programming language. The second style of SOAP processing is message-based. Instead of invoking remote procedures, it provides transfer of information, without a client's knowledge of a particular method on some server.

For service functionality, based on various proposals such as AN335, AN412 and AN451, TV-Anytime metadata service functionality to be evaluated in this paper is defined as following table 1.

Service Name	Parameters	Returned data
get_Resolution	CRID list	CRT
get_Metadata	CRID list	PIT/GIT
searchOn_Description	Metadata query	PIT/GIT
searchOn_Delivery	List of channels, time range	PLT
searchOn_All	Logical AND of above 3 parameters	PIT/GIT

Table 1: Service functionality
CRT: ContentReferencingTable
PIT:ProgramInformationTable
GIT:GroupInformationTable
PLT: ProgramLocationTable

(1) "get_Resolution" services offers location resolution functionality (ContentReferencingTable), as defined in the Content Referencing specification[10] by send CRID as a parameters for query.

(2) "get_Metadata services allows a client to retrieve the corresponding metadata (ProgramInformationTable or GroupInformationtable) for each CRID by using CRID as a parameter to query

(3) "searchOn_Description" services allow a client to query a server in order to retrieve TV-Anytime data for a set of program (ProgramInformationTable or program groups or (GroupInformationtable) by using metadata query (such as a keyword) as a parameter.

(4) "serchOn_Delivery" services allow client to query schedule information (ProgramLocationTable)

(5) "searchOn_All" services offers two or three of the "get_Metadata", "searchOn_description", and "searchOn_Delivery" services can enable combined queries

Note that, Program metadata is description for audio-visual contents and content referencing information is used for locating contents by using CRID. CRID is an abbreviation of Content Referencing Identifier that is used for acquire contents.

In our implementation, "get_Resolution" and "searcOn_Description" service functionality are implemented.

3. System detail and Implementation

Following section 2, system detail and our implementation is clarified as follows:

3.1 Publishing and Discovery service

We registered the service ("TV-Anytime metadata service") for acquire UDDI at https://uddi.ibm.com/testregistry/publishapi which is for UDDI testing registry

Client can finds the service "TV-anytime metadata service" at https://uddi.ibm.com/testregistry/inquiryapi by using service provider name or service name (in this implementation service provider name is "GITS").

The URL addresses form above is used for

publishing and discovering by using only API. Our implementation used WSTK3.2.2's API (IBM Web Services Tool Kit).

3.2 Service Description

WSDL is used for description interface and implementation of service. When we created application service program based on WSDL description for TV-Anytime web services from AN335, Apache Axis' tool is used for converting application program to WSDL file. Then, put it on a directory of web application server. Because when client found the service, WSDL file is accessed for binding on the service to invoke application service.

3.3 Metadata Transportation

In our system, we adopt both SOAP processings (RPC and messaging). The overview of this system is shown in figure2.

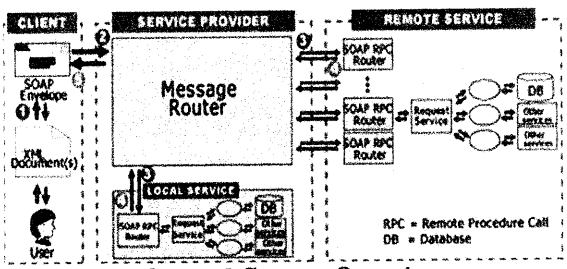

figure 2:System Overview

For our system, the detail of processing can be clarified as follows:

(1) The query from client (XML instance document) is wrapped by SOAP envelope and then is sent to "Message router" as a document in service provider.

(2) When "service provider" receives request message from the client, message router will check request type for determining location of service application (local or remote source)

(3) And then "Message Router" sends request to selected "RPC Router" for business processing such as database application, etc.

(4) After obtaining the service, "RPC Router" will return the service response to "Message Router".

(5) Then, the service response is wrapped by SOAP envelope and sent to the client.

In this implementation TV-Anytime forum's metadata specification[1] are used for describe audio-visual contents.

We implemented "get_Resolution" and "searchOn_Description" functionality. The system is shown in figure3.

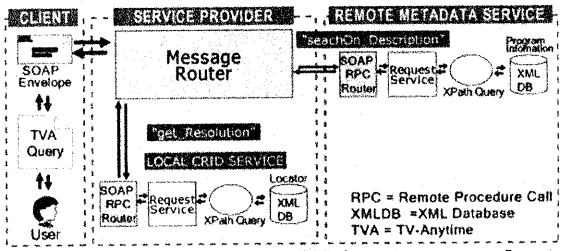

figure 3: Utilization with TV-Anytime metadata

"searchOn_Description service is for acquire TV program information by sending query keyword (such as "action", "soccer" and etc.) and second one is "get_Resolution" service is for acquire location resolution by using "CRID" (such as "crid://ntt.co.jp/blade2")

The XML technologies used in our implementation are shown in table 2.

Transmission	*SOAP*
Storage and Retrieval	*XML database*
Query	*XPath*
Access and handling	*DOM, SAX*

Table2: XML technologies in implementation

4. Experimental Results

First of all, client accesses to https://uddi.ibm.com/testregistry/inquiryapi for discovering TV-Anytime metadata service. After client found the service (TV-Anytime metadata service), client also knows the WSDL file's address of the service. And then client accesses the WSDL file for binding the service. So, if client requests "get_Resolution" service, the query information from client is shown in figure 4 and service is invoked from local machine by using SOAP RPC router. After retrieved information from the database, service response is returned to client as following in figure 5.

If the request service from client is searchOn_Description", message router decides to use service form remote machine

(service provider machine operating system is Linux while as the remote machine is run on Windows platform) and invoked the service by using SOAP RPC router. The request and response is shown in figure 6 and 7 respectively.

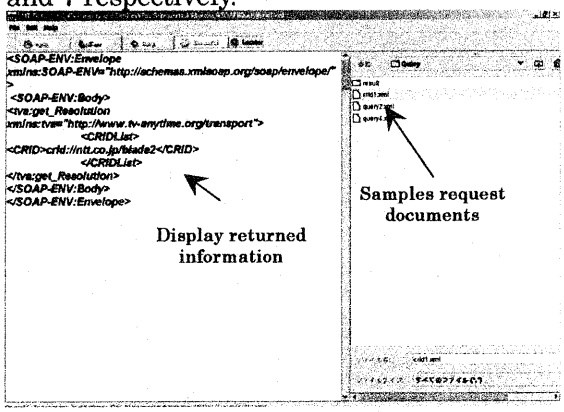

figure 4 : "get_Resolution" request

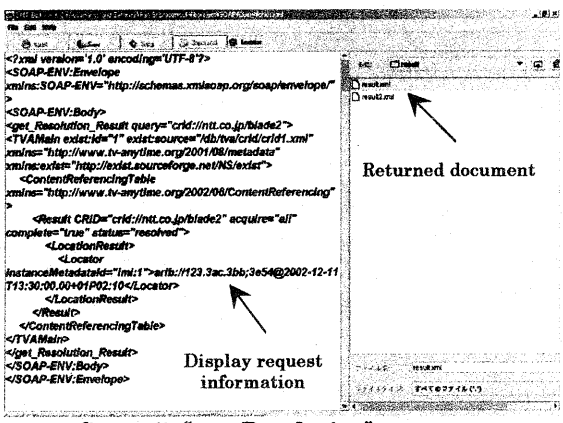

figure 5: "get_Resolution" response

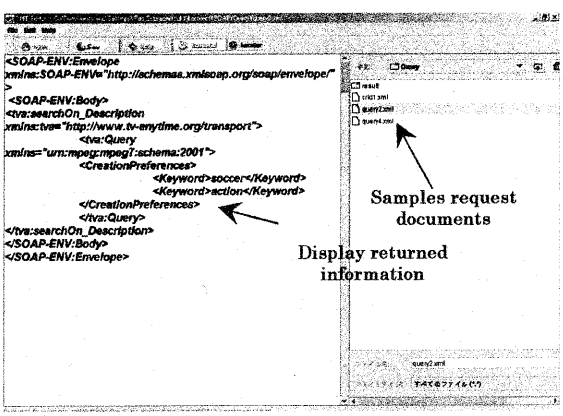

figure 6: "searchOn_Description" request

Using the system, client can receive service response from "metadata provider" or "CRID provider" without needing to know their location and service implementation, etc. Client side programming only needs to know URL of service provider and service name of service.

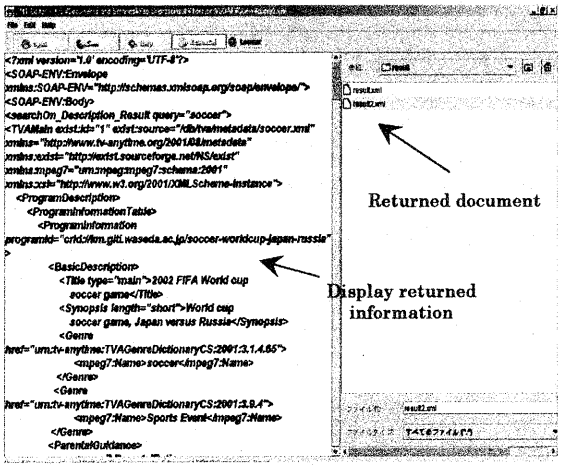

figure 7: "searchOn_Description" response

5. Evaluation for this implementation

The our evaluation is summarized as follows

(1) Time for discovery service is fast. In our implementation, client can found requested service that is published outsides Japan (IBM's UDDI database) by a few seconds (3-4 seconds). Our client runs on Redhat Linux 7.3 pentium III 800MHz memory 256 MB.

(2) TV-Anytime metadata services that have several optional parameters. It seems to be, it is not appropriate to use SOAP-RPC because every parameters must be included in a invoke procedure call. But, in our implementation, after WSDL file is accessed, client can receive all of service interface information such as parameters and method name effectively. So, SOAP-RPC is also can be used freely in the client and server side.

(3) In SOAP messaging, message router decides where service should be provided by considering on request service document from client. In the other words, the client

does not depend on the server or the server's procedure. The client and the service agree on the format of the message.

For example, in our implementation if start element of request service document is "<get_Resolution>", in service provider program must have to "get_Resolution" method for providing the service. It's also not need to do many things in programming. It focus is on the message itself rather than on objects and methods.

(4) Using SOAP-RPC to send XML document need to convert document to object (such as "string" object) and then serialize object to XML and send. In addition, characteristic of metadata for audio-visual contents is large such as hundreds of program information results. So that, time for processing when sending large data is slow than using SOAP messaging.

(5) Therefore, in web services, metadata exchange service for audio visual contents should use in SOAP messaging. The reason from above(4). And when, receiver received information, it can be used without dealing with object such as conversion object to XML document. Besides, many organizations have been trying to specified metadata for audio-visual content (even query service format) for achieve interoperability such as TV-Anytime forum and MPEG-7. Then, User and service provider can agree on the format easily.

6. Conclusion and Future work

A part of metadata exchange services based on AN335, AN412 and AN451 proposals in TV-Anytime forum is implemented using web services. And experimental results are evaluated.

In this implementation, using UDDI for discovery the service and accessing to WSDL file for binding the service are efficient. But for transportation metadata should utilize SOAP messaging rather than SOAP-RPC

For our future work, once SP006v1.0 is completed, we will implement full functionalities based on the specification for evaluating different aspects of metadata exchange service, and to find what is missing in the specification.

7. References

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[5]http://www.w3.org/ws

[6]TV-Anytime Form, "Delivery of Metadata over a Bi-directional Network", SP006v1.0 as specification draft, 10 October 2002, http://www.tv-anytime.org

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[10]TV-Anytime Forum, "Content Referencing Specification version 1.2", SP004v12, 28 June 2002, http://www.tv-anytime.org

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