

# A Method of UDDI Service Subscription Implementation

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**Abstract**—In the heterogeneous environment of the multi-registry centers, owing to the traditional updating data burden, the data of the affiliated registry center cannot synchronize with the root registry center in real-time. Although therefore the special UDDI service subscription mechanism had ever defined, most present UDDI registry centers don't support the function of subscription nowadays. Therefore, aiming at the problem and the limitation, the implementation method of the registry to support subscription has been proposed on the basis of analyzing the information interaction mode and function requirements of subscription. Moreover, the certain instance has been implemented with the method based on UDDI specification and Java language so as to the real monitoring, feasibility and practice to be proved.

**Keywords**—subscription mechanism; multi-registry centers; service; synchronization

## I. INTRODUCTION

With the development of Web Services, the integration of heterogeneous systems has been implemented, owing to XML providing the ability of data description, SOAP solving the transmission problem, and WSDL (Web Services Description Language)[1,2] endowing Web Services with self description ability. As the focus technology, the dynamic integration of system has been studied, especially for the dynamic integration of service. Business entities must be able to allow business partners to know that they can provide services anywhere and anytime. At the same time, they must also be able to discover the services persistently which potential business partners are able to provide, so that the modern electronic commerce can be done on demand. Hence the Universal Description, Discovery and Integration Technology (UDDI)[3] are proposed, which makes enterprises find Web Services easily. UDDI is a key technology for Web Service to publish services and inquiry operations[4], which provides a universal description, discovery and integration of Web Services. Moreover, the Combination of the UDDI and the WSDL can realize inquiry operations of the Web Services.

In view of the development and application of registry center, the structure of it tends to be more complicated and large, which leads to the worse usage of the UDDI. One hand,

the registered information of UBR is completely copied among affiliated registered nodes, and which leads to the increasing number of services register centers, the registry center becomes difficult to be maintained and managed; On the other hand, UDDI currently can only provide passive directory services, few organizations or individuals update the registry information initiatively after the services are published, and the effectiveness of services cannot be guaranteed. Therefore, the subscription mechanism is proposed, which improves the effectiveness of the service information in the UDDI registry center. With active service monitoring and informing, it appropriately supports the affiliation of the registry center as well.

## II. UDDI SPECIFICATION

The UDDI 1.0 Version Specification describes the standard target, basic concepts, framework and main data structure of the UDDI (Such as basic business contact information in the directory structure, etc.). It is a symbol of the UDDI's birth. But this unspecific version is not a reliable specification which meets the industry standard. The UDDI 2.0 Version Specification which released in May 2003, is the first reliable UDDI specification[5]. The improvements of version 2.0 included:

- 1) Provide modeling support for complex organizations;
- 2) Support more powerful clients classification and identifier, and add more guides in description of enterprise information;
- 3) Provide enhanced query, add the directory of specific products and services;
- 4) Add the support of external taxonomy;
- 5) Possess international capabilities;
- 6) Base on peer-to-peer replication.

Currently, the latest version of the UDDI specification is version 3.0.2[6]. The UDDI v3 improves and develops the UDDI specification comprehensively. It strengthens the ability of registering. Although the initial version of UDDI, has already included such as the concept of commission and distributed among the servers, but the earlier definition relies on proprietary interactive mode. Therefore, a relatively open standard provided by UDDIv3, ensuring broad interoperable

exchange. UDDIv3 also supports the function of digital signature. It has the ability to extend discovery, combining numbers of simple steps queries to a single-step complex query. It also supports a query containing a sub-query, allowing the customers to narrow their search more effectively. At the same time, V3 also adds a subscription feature, which users can publish a subscription object to subscribe in the designated content or scope of the registry center.

### III. SUBSCRIPTION INTERACTION

Under the environments of multi-registry centers, subscription mechanism can be applied in the structure which one or more affiliated registries manage the registered items relying on a root registry, can also be applied in the structure which one or more service users manage the registered items relying on an affiliate registry. Figure 1 shows the subscription interaction in multi-registry, basing on the above two structures.

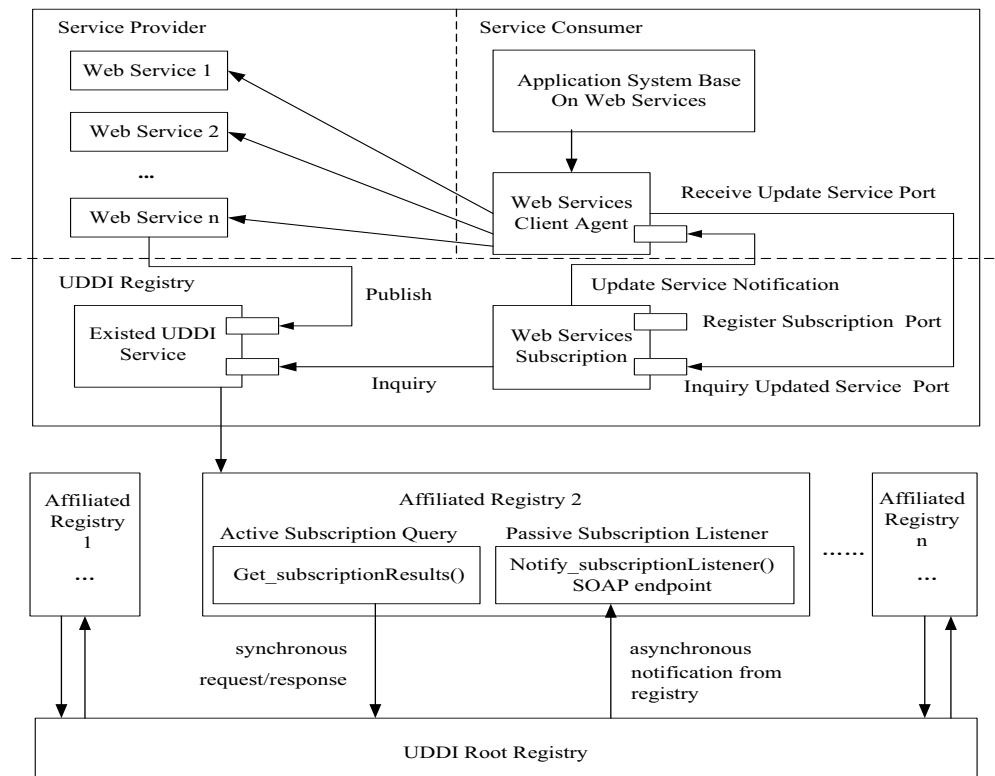


Figure 1. Subscription interaction.

A affiliated registry center need to monitor the changes of the root registry center, and then feedback a copy of the changed item to the affiliated registry center. For example, a affiliated registry center can identify the types of items, when these items are added, changed or deleted by the publishers who own them, the affiliated registry center track the changes in the contents of the UDDI registry center through a synchronous request or asynchronous notification to the registry center by the requesting party. In this way, the affiliated registry can keep up-to-date easily.

Moreover, the service users registered in the affiliated registration center can also subscribe the services that they interests in the same way. In this paper, the subscription interaction pattern of asynchronous notification is selected to implement subscription.

### IV. THE FUNCTION MODULE OF SUBSCRIPTION

In order to ensure the initiative, instantaneity and effectiveness of the subscription, the main functional requirements of subscription mechanism present as follows: The subscribers, according to their own requirements, publish subscription information, and can get the required service timely and accurately[7]; A Published subscription information can be updated in time when the requirement of subscription changes, so that the effectiveness of subscription service can be guaranteed[8]; All the subscription information can be deleted completely when it is out of need.

Therefore, referring to the requirements of subscription, subscription mechanism can be implemented in the five functional modules as follows[9]: publishing subscription information module (PublishSubscription), monitoring and receiving subscription information module (MonitorSubscription), updating subscription information module (UpdateSubscription), deleting subscription information module (DeleteSubscription), getting and checking subscription information module (GetSubscription).

The base attributes of UDDI Objects used in the five functional modules present as follow: there are entity (SubscriptionEntity), service (SubscriptionService), and binding (BindingTemplate) in UDDI data structures, which are used to describe the basic subscription information[10]; The Subscription filter (SubscriptionFilter) which is used to appoint subscription range[11]; The class of finding

subscription service (FindService) and the listener of subscription changes (notify\_subscriptionListener), etc.

#### 1) Publishing Subscription Information Module

The timing diagram of publishing subscription information module is illustrated in Figure 2.

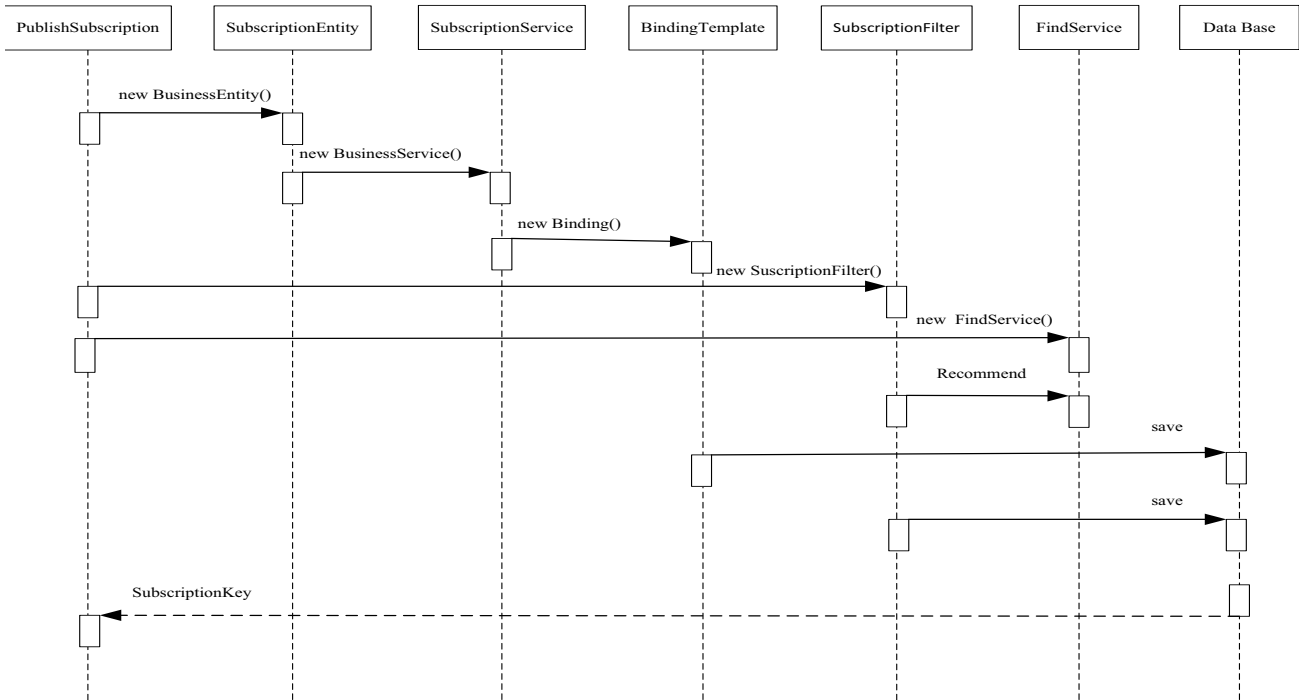


Figure 2. The timing diagram of publishing subscription information module

The design of publishing subscription information module means to build a subscription object (such as subscription of timing diagram), and appoint its subscription type (synchronous or asynchronous), the range and parameter. The design of publishing subscription information module, which means to build a subscription object (such as the subscription of timing diagram), and appoint its subscription type (synchronous or asynchronous), range and parameter as well. And after subscribing successfully, the returned object of Subscription Class must include at least one SubscriptionKey, which is the only main key (uuidKey) of this subscription object to distinguish other subscription object.

#### 2) Monitoring and receiving subscription information module

The changes of the subscription operation will trigger the subscription change monitor, such as modification, addition and deleting. According to the designated subscription type of publishing subscription information module, the monitor will send synchronous or asynchronous notification to the subscribers, and then the subscribers will get the information of subscription results.

#### 3) Updating subscription information module

When the types and other parameters of subscription change, the subscription information can be queried by the unique uuidKey of subscription object, and be modified as well. After modifying the relative items, this subscription information will be resaved. According to the updated subscription, the subscription change monitor will inform the subscriber with new subscription results.

#### 4) Deleting subscription information module

When deleting a designated subscription object with its unique uuidKey, it a DeleteSubscription object should be built to execute deleting operation. Then the monitoring and receiving subscription information module will cease this subscription, and do not send the notification of subscription result any more.

#### 5) Getting and checking subscription information module

The timing diagram of checking subscription information module is illustrated in Figure 3. This module is a synchronous subscription alert, which is used to get and check either historical information of subscription result or the missed alert of subscribers. Firstly, this GetSubscriptionResults object should be built, whose returned value type is a list of SubscriptionResultsList. Through traversing the list, every item

of the result sets which fulfill all the inquiry conditions, will be required in the setting time.

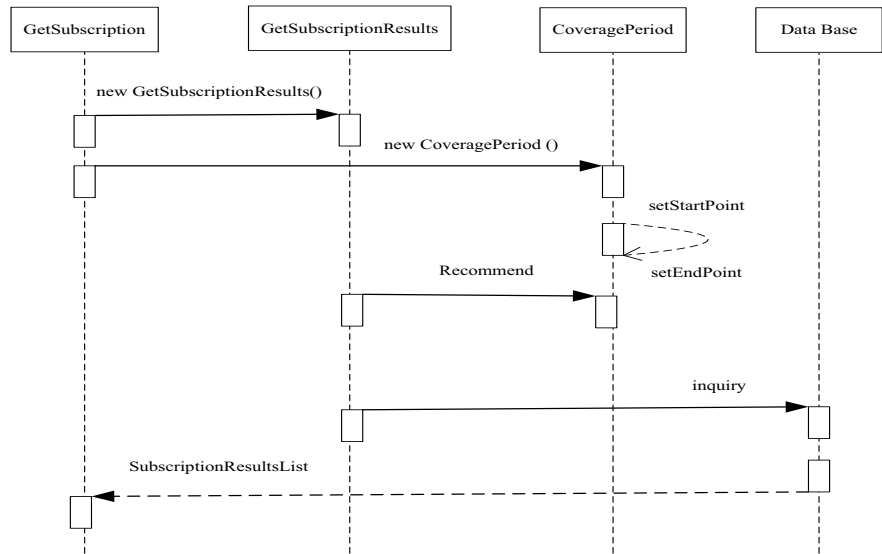


Figure 3. The timing diagram of checking subscription information module

## V. RESEARCH ON THE REALIZATION OF SUBSCRIPTION METHOD

Nowadays, most UDDI registry centers don't support the function of subscription. Firstly, functions of the UDDI registry centers need to be expanded to realize subscription, and then the service subscription mechanism can be supported. Both two methods can be used to realize the subscription:

1) *Real-time monitoring*: A subscription with the UBR node operator should be built, to monitor the UBR activities of publishing or updating in real-time. When these activities happen each time, you need to check whether there are services relating to subscriptions. If there are, you need to send notifications to subscribers according to the preset rules;

2) *Polling*: An independent subscription service should be developed to deal with all the issues of service subscription. It can inform the subscriber when the subscription service was found by polling the UDDI updating service.

The problem of polling method is of poor real-time. If the service information changes between two polling operations, it won't notify the service subscribers immediately, until the next polling happen. So we choose the real-time monitoring method to realize Web Services subscription service.

## VI. IMPLEMENTATION OF SUBSCRIPTION

The UDDI client system can be built with the UDDIv3 specification, the open source tools JUDDIv3 and Java programming language, which is based on a structure of B/S[12]. A simple subscription instance of Association of Electronic Producers (AEP) is built on the real-time monitoring method.

AEP provides membership for manufacturers in its organization to achieve the standard of high quality[13]. With membership, manufacturers can obtain any Web Services which is provided by the AEP, such as invoices etc. However, how to find the universal required services out of tens of thousands of Web services in UBR quickly becomes a key problem to the AEP. Therefore, we can develop a subscription service to solve it.

The AEP operates an affiliate registry of UBR, which is available for its members only. The AEP duplicates the copies of interesting services from UBR to the affiliate registry[14]. The subscription of the AEP can be implemented through the real-time monitoring method as follows:

1) *Publishing the subscription of the AEP*: Firstly, a subscription with a UBR node operator should be built to monitor its interested relevant UBR activities. Secondly, the parameters (such as name, uuidKey, etc.) and filter standard should be set. Based on UNSPSC, this filter standard is classified as a kind of electronics manufacturers' service [15]. The SOAP message of publishing subscription information is shown in Figure 4.

2) *Monitoring the subscription of the AEP*: The UBR node is monitored by the subscription change monitor in real-time. The changes of the operation from the set of subscription results such as the modification, addition and delete, will trigger this monitor. While an asynchronous interaction mode is applied, asynchronous notification can be requested by the SOAP message of its interested activities.

3) *Getting the subscription of the AEP*: After having received the asynchronous notification, the program of the AEP subscription monitor will send request to UBR to retrieve all the businessEntity related with uuidKey, and integrate them into the affiliate of its own. The responding SOAP message

which is sent from registry center to the subscriber is shown in

```

1 <soap:Envelope xmlns:soap=http://schemas.xmlsoap.org/soap/envelope/
2 ...
3 <soap:Body xmlns:ns1="urn:uddi-org:api_v3">
4 <ns1:save_subscription xmlns="urn:uddi-org:sub_v3">
5 <ns1:authInfo>AEP_AuthCode</ns1:authInfo>
6 <ns1:subscriptions>
7 <ns1:subscription brief="true">
8 <ns1:subscriptionFilter>
9 <ns1:find_service xmlns="urn:uddi-org:api_v3">
10 <ns1:categoryBag>
11 <ns1:keyedReference
12 tModeKey="uddi:ubr.uddi.org:taxonomy:unspsc"
13 keyName="AEP"
14 keyValue="50.20.20.02.00"/>
15 </ns1:categoryBag>
16 </ns1:find_service>
17 </ns1:subscriptionFilter>
18 <ns1:bindingKey>uddi:AEP.org:subscriptionListenerService:binding
19 </ns1:bindingKey>
20 <ns1:notificationInterval>P1D</ns1:notificationInterval>
21 <ns1:maxEntities>1000</ns1:maxEntities>
22 </ns1:subscription>
23 </ns1:subscriptions>
24 </ns1:save_subscription>
25 </soap:Body>
26 </soap:Envelope>

```

Figure 4. Publishing subscription SOAP message.

It is certified by the realization of above examples that the real-time monitoring method has absolute superiority. The appropriate service subscription information will be checked as soon as Web Service is published or updated, and be fed back to the subscriber quickly. Therefore, this method owns a gorgeous real-time, and greatly improves the flexibility and efficiency of processing services in UDDI. Moreover, this mechanism solves this problem, though only getting the interesting information instead of copying the whole, that the multi-registry becomes more complex and enormous.

## VII. CONCLUSION

In this thesis, real-time monitoring method and polling method are proposed to realize the function of subscription. Through comparison between two methods, real-time monitoring method possess better real-time. In the first method, the publishing and updating interfaces of UDDI are modified to monitor and feedback the subscription results in real-time. It radically solves the problems, proposed in the article quotes, that the multi-registry is enormous, complicated and inefficiency. And then the subscription mechanism creates a stronger fundamental structure for Web Services environment. Moreover, UDDIv3 includes lots of other new functions, such as: publishing across multiple registries, policy and multi-version support and so on.

Although the UDDIv3 has so many functions, many problems still exist in UDDI technology, such as: the safety, reliability and integrity of registered data can't be fulfilled; various Web services are just described without evaluating. We believe that the perfection of UDDI will promote the development and application of Web Services technology greatly. We will make a further research and discussion on improving the of UDDI service technology.

Figure 5.

```

1 <soap:Envelope xmlns:soap=http://schemas.xmlsoap.org/soap/envelope/
2 ...
3 <soap:Body xmlns:ns1="urn:uddi-org:api_v3">
4 <notify_subscriptionListener>
5 <subscriptionResultsList>
6 ...
7 <keyedReference
8 tModeKey="uddi:ubr.uddi.org: taxonomy:unspsc"
9 keyName="Electronic"
10 keyValue="50.20.20.02.00"/>
11 ...
12 <bindingKey>
13 bindingKeyOfTheClients
14 NotifySubscriptionListenerService
15 </bindingKey>
16 <notificationInterval>P1D</notificationInterval>
17 <maxEntities>1000</maxEntities>
18 ...
19 </subscription>
20 <keyBag>
21 <deleted>false</deleted>
22 ...
23 </keyBag>
24 </subscriptionResultsList>
25 </notify_subscriptionListener>
26 </soap:Body>
27 </soap:Envelope>

```

Figure 5. Responding subscription SOAP message.

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## REFERENCES

- [1] Hinnici R, Gudgin M, Moreau J, et al, Web services description language (WSDL) version 1.2 part 1: core language [EB/OL],<http://www.w3.org/TR/wsdl12>, 2003
- [2] Gudgin M, Lewis A Schlimmer J, Web services description language (WSDL) version 1.2 part 2: message patterns [EB/OL], <http://www.w3.org/TR/wsdl12-patterns>, 2003
- [3] Universal Description, Discovery and Integration (UDDI 2.0). UDDI technical white paper [EB/OL],<http://www.uddi.org/specification.html>, 2001
- [4] Du Zongxia, Huai Jinpeng, Research and implementation of an active distributed Web service registry. Journal of Software, vol 17, pp.454-462, March 2006.
- [5] Jiamao Liu, Ning Gu, Yuwei Zong, Service registration and discovery in a domain-oriented UDDI Registry, Computer and Information Technology, vol 31, pp.276-283, December 2005.
- [6] Clement L, Hatley A, Riegen C V, et al, Universal description discovery & integration (UDDI) 3.0.2 [EB/OL], <http://uddi.org/pubs/uddi-v3.htm>, 2004
- [7] Chen Pei-xing, A sub/pub- based integration method of service enable C2 system, Fire Control & Command Control, vol 34, pp.8-39, May 2013.
- [8] Yiran Wang. Reserch, impementation and intelligent improvement of Web service register client side based on UDDIv3 , Beijing University of Post and Telecommunications, pp.52-58, 2011.
- [9] Yanan Hao, Yanchun Zhang, Jinli Cao, Webservices: discovery and rank: An information retrieval approach future generation computer systems, vol 26(8), pp.1053-1062, August 2010.

- [10] Wu Feng, Xu Yuelei., Research and optimization on UDDI service registry, *Modern Electronics Technique*, vol 34, pp.19-20, December 2011.
- [11] Yanqin Zhang., A data consistency optimized model in distributed UDDI, *Fire Control & Command Control*, vol 37, pp.845-847, May 2012.
- [12] Wang Jianbin, Hu Xiaosheng, Li Kangjun, Zhao Jing, Comparison and combination of Web services in rest. Style and Web services based on soap, *Computer Applications and Software*, vol 27, pp.299-304, September 2010.
- [13] Li Juan, Ming Deting, Qiu Xiaohong, A Web services discovery mechanism based on peer-to-peer network, *Microelectronics & Computer*, vol 27, pp.152-154, February 2010.
- [14] Li Huang, Ye Feiyue, Subscription invoking model of Web services based on mobile agent in mobile computing, *Computer Engineering and Design*, vol 31, pp.339-1441, June 2010.
- [15] E. Damiani, S. D. C. di Vimercati, S. Paraboschi, P. Samarati, A fine grained access control system for XML documents , *ACM Transactions on Information and System Security*, vol 5, February 2002.