Exploring UDDI Registries Using Modified OFDAV Browser

Biao Jiang
Faculty of Information Technology
University of Technology, Sydney
bjiang@it.uts.edu.au

Mao Lin Huang
Faculty of Information Technology
University of Technology, Sydney
maolin@it.uts.edu.au

Abstract: This *paper introduces a framework of interactive navigating through the web-based UDDI Business Registries. By creating a 2D interactive visual interface, service requesters are able to visually navigate through the large information hierarchies that are usually used to present the UDDI Business Registries. Instead of using the traditional keywords or click-through searching methodologies, which are often inefficient and less obvious, we use a visualization technique, namely Online Force-Directed Animated Visualization (OFDAV), to create our visual interface. A simplified prototype with visual interface has been developed for the purpose of demonstration.*

Keywords: web services, UDDI business registry, graph visualization, information hierarchy, and graphic user interface.

1. Introduction

The term Web Services has gained great momentum in the last couple of years. A Web Service is a platform and implementation independent software component, and it can also be viewed as a business process for application integration with in a company or among the business partners. From a technical perspective, a Web Service is nothing but a collection of related operations that are accessible over a network and are described by a service description.

A typical architecture of Web Services is a Service-Oriented Architecture (SOA) which consists of some roles and operations [1]. (See Figure 1)

Three main roles are a service requester, a service provider, and a service registry.

- *Service requester* can find the required service via the UDDI interface and then may use the information provided to directly bind to the particular service.
- *Service provider* creates web service and its services definition and then publishes them by registering with a registry based on a standard, namely the Universal Description, Discovery and Integration (UDDI) specification.
- *Service registry* maintains a registry of published web service descriptions.

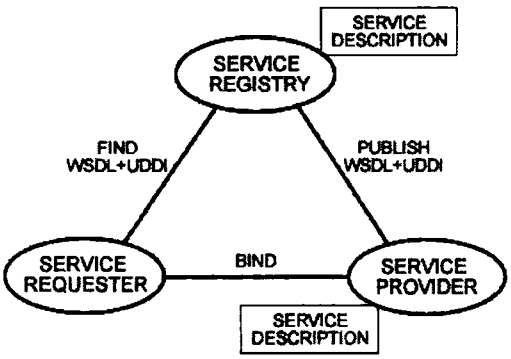


Figure 1 Service-Oriented Architecture of Web Service

The framework of Web Services is essentially founded upon three major technologies, i.e., communication protocols, service description and service discovery.

- *Simple Object Access Protocol* (SOAP) which enables communication among web services [2].
- *Web Services Description Language* (WSDL) which provides a formal, computer-readable description of web services [3].
- *Universal Description, Discovery and Integration* (UDDI) directory which is a registry of web services description [4].

The UDDI specification enables business to quickly, easily, and dynamically describe its business, find and transact with one another. It also provides a place for a company register its business and services that it offers. People or businesses that need a service can use

this registry to find a business that provides the service.

According to the specification, UDDI Business Registry offers two kinds of interfaces, i.e., a web-based user interface and a programmatic interface. In this paper, we focus on discovering business and services through web-based user interface of a UDDI Business Registry.

1.1 Problems

One of the main objectives of UDDI Business Registries is the discovery of services. This entails a form of search through a larger space of entries. Therefore, the basic requirement for UDDI is to perform intelligent searches. Until now, the best mechanism to facilitate such searches is the taxonomic categorization and classification. Categorization is the process of creating categories, whereas classification is the process of assigning objects to these predefined classes. UDDI specification includes three predefined classification schemes:

- North American Industry Classification System (NAICS) for classifying businesses by industry [5].
- United Nations Standard Products and Services Classification (UNSPSC) for product and service classifications [6].
- ISO3166 Standard for geographic location classifications [7].

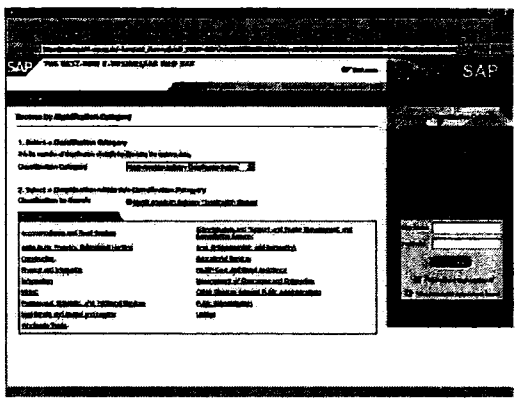


Figure 2 A typical example of a traditional navigation interface

In order to take advantage of these schemes, service providers need to provide the relevant classification information as they register their entries. While the current web-based UDDI Business Registry can effectively assist the businesses in registering themselves and discovering the other desired businesses through internet, they usually do not provide a 2D graphic user interface that gives users a sense of information space as users exploring the service registry to discover the desired businesses and services. For instance, the SAP UDDI business registry is one of the top leading registries currently available online. It uses click-through browsing methodology that provides users a series of textual link lists located in several pages for navigation. Each list in a page shows only one level of information hierarchy. (See Figure 2)

The problem is that if the user is not familiar with any of these Standard Industrial Classifications (SIC), it could be a nightmare for user to find their desired business entries and services through the ordinary browsing activities. Under the traditional navigation scheme, users have to click through many pages to move down and up the classification hierarchy to find out appropriate businesses they need. The entire business and service classification hierarchy structure is broken into many small pieces in different level and it becomes very difficult for user to percept the overall structure of the classification hierarchy without previous classification knowledge and only by reading those textual lists. Therefore, the effectiveness of the navigation mechanism in terms of click-rates and human cognitive process are lower. Also, this navigation mechanism lack of the sense of information space, the network loading for navigation is heavier.

A simple visualization technique, Image-Map Browser, has been developed to address the above issues [8]. But it also creates following problems:

- All the classification information displayed on the screen is static. Since the images that represent the subset of classification hierarchical structure in IM-Browser are predefined and stored in several different files. They cannot be changed dynamically at runtime. Swapping images is the only way to achieve navigation through the UDDI registry. Therefore, the actual behavior of Image-Map Browser is not dynamic.
- It is very difficult to modify the UDDI Registry if the classification scheme is updated, especially for the real UDDI Registry with very fine classifications. Every new version of classification scheme published, the image files represent the subset of classification have to be redrawn. Therefore, it is not feasible in reality to use IM-Browser for exploring large information hierarchy.
- Third-Party classification scheme may be used in some ad hoc industries. Although standard classification schemes are essential for UDDI Business Registry to organize and classify entries, a particular industry might

want to define a new taxonomy to detail product classifications according to a scheme commonly used in their industry.

To address the above problems, we use another visualization technique, *Online Force-Directed Animated Visualization (OFDAV)* [9], to generate a dynamic graphical user interface for the display and navigation of the classification hierarchy of UDDI Business Registries. OFDAV technique greatly enhances the quality user interface in terms of readability and comprehension. OFDAV-Browser uses an exploratory model of visualization allowing users to navigate huge hierarchies that are partially unknown.

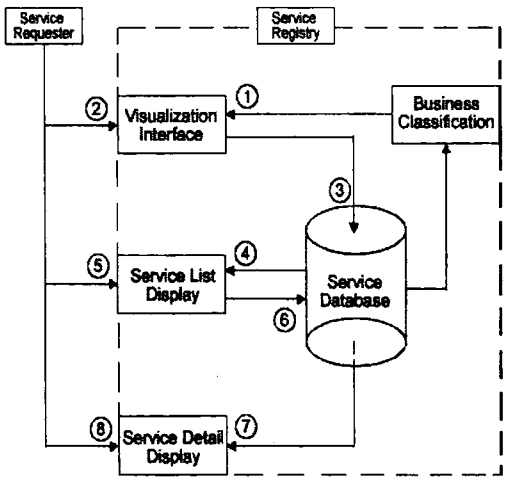
In OFDAV, the classification hierarchy under visualization is treated as a rooted large tree, i.e., a huge graph. The user's view is focused on a small sub-graph of the huge graph at any point in time. The visualization of this sub-graph is called a logical viewing frame and is defined by its focused nodes. Conceptually, the focused nodes form a first-in-first-out queue with the user's highest interest focus. The viewing frame is updated smoothly following the changes of the user's interested focus. It adopts a force-directed graph drawing algorithm [9] to draw the sub-graph and as logical neighborhood of this sub-graph. A force-directed algorithm views a graph as a system of bodies with forces acting between these bodies. The bodies are represented nodes in the graph, and the forces are relationships between the nodes in a graph and determine the geometrical positions of the nodes. A force-directed algorithm aims to compute a position for each body such that the sum of the forces applied on each body is locally minimized. It uses multiple animations to guide the user between logical viewing frames in order to reduce the cognitive effect and preserve the mental maps.

2. Visual UDDI Business Registry

2.1 The framework of UDDI Business Registry

The components of a simplified web-based visual UDDI Business Registry and interconnections among them can be described in a diagram shown in Figure 3. Each component is presented by a rectangle in the diagram, which each edge in the diagram presents a workflow.

- Visualization Interface
  A navigational visual presentation automatically displays a sequence of the subset of classification hierarchy according to viewer's orientation. It allows viewers to interactively navigate through the entire classification hierarchy by smoothly updating logical viewing frames that represent the subset of the hierarchy. It also addresses the "small window" problem in large information space.



These work flows are:

(1) display visualized standard business classification
(2) navigation through SIC visual interface
(3) query selected businesses or services
(4) retrieve business or service list and display
(5) select a particular business or service
(6) query selected business or service
(7) retrieve a service detail and display
(8) further action taken

Figure 3 A framework of visual UDDI business registry

- Service List Display
  A web page is generated by web server according to user's request. The registry accepts a request from presentation layer, sends a query to the database and retrieves the list of appropriate business services from the database in correspond to mouse-click on a particular graphic leaf node in the visual interface. It then displays the available business or services with a link to its details.
- Service Detail Display
  A web page is generated by web server in corresponding to user's request similar to the service list display above. Instead of displaying a list of business or service class, it shows business or service detail information according to requester's particular interests.
- Service Database
  A relational database is employed to store the details of Standard Industrial Classification and

the business and service information available in UDDI business registry.

2.2 The Implementation

Since we only focus on design of web-based user interface for the exploration of business services through the SIC in UDDI business registries, the implementation of the prototype is much simpler than the real application. The brief summary of implementation is shown as follows.

- Presentation Layer
  A graphic user interface, OFDAV Browser, provides direct interactions between users and UDDI business registry system. Java and client-side scripting language are used to implement this prototype at the presentation layer in order to minimize the client side request. As mentioned above, the web-based UDDI registry employs standard industrial classification as classification scheme. This scheme is a hierarchical information structure which is treated as a rooted tree under visualization.
- Business Logic Layer
  A business logic control layer, which accepts the request from presentation layer, passes the request to backend database and then retrieves the data from the database and sends the respond information back to presentation layer. In terms of the simplicity and popularity, a well-known Apache HTTP Server with PHP is adapted to implement the business logic layer in this prototype.
- Data Source Layer
  A data storage entity maintains the information used by UDDI Business Registry. An open source RDBMS, namely MySQL, is used to implement as data source in this prototype due to its popularity, scalability and well integrated with PHP and Apache Web Server.

3. An Example

A simple example session is presented here in order to illustrate how users are able to dynamically navigate through the large hierarchy of the UDDI business registry by using OFDAV Browser interactively. For example, suppose that a user intents to find the services of Travel Agency business.

The OFDAV Browser displays two frames. The left frame displays a sub-graph of the entire hierarchy of the Standard Industry Classification (SIC) while the right frame displays either the SIC Code descriptions that correspond to the sub-graph displayed in left frame, or searching results for a particular target business or services. Figure 4 shows a root level structure of the SIC.

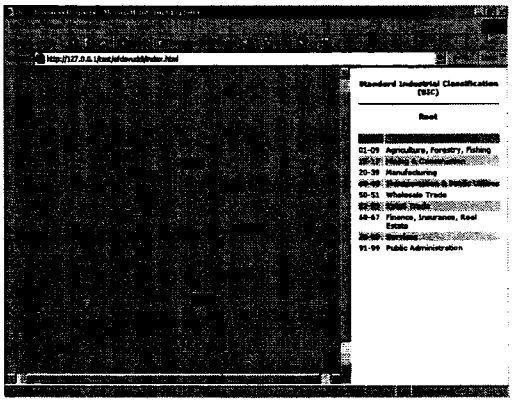


Figure 4 The root level (first level) of SIC

The user can navigate the entire hierarchy by changing the focus node. This can be done by selecting a sequence of interested nodes. The sub-graph displayed on the left frame is updated smoothly following the mouse clicks. Both visual structure and text descriptive information of the SIC are displayed in the left and right frames. For instance, when a user clicks on the node labeled 40-49 of the SIC code, the corresponding descriptions are displayed in the right frame (See Figure 5).

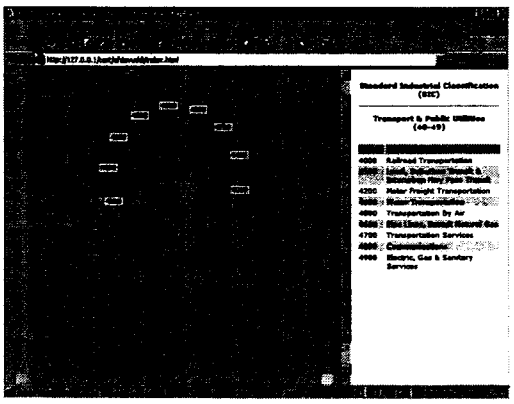


Figure 5 The Transportation & Public Utilities level (second level) of the SIC information hierarchy

The same process applies to the display of the next level of SIC information hierarchy, by clicking on the node labeled 4700 of the SIC code.

At the lowest level of the SIC hierarchy, each leaf node is associated with a PHP file which can dynamically generate a list of related target business or

services from the backend database. In Figure 6, if the user clicks on the leaf node 4724-00, then a list of Travel Agencies and the related information describing these Travel Agencies will be displayed.

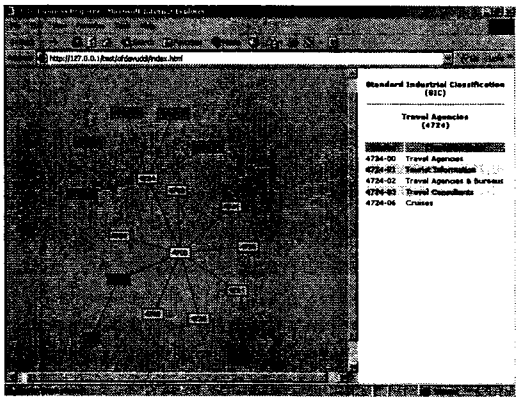


Figure 6 The Travel Agencies level (leaf level) of SIC information hierarchy

This enables service requesters to select and find out their desired services by just clicking on related links in the right frame to view the details of selected business and services. The binding action may be taken if the further invoking process required.

4. Conclusion

The framework we introduced in the paper provides a 2D interactive visual interface for navigating any kind of standard classification hierarchies of UDDI Business Registry. A simplified the web-based prototype is developed by using some open source technologies. This visual interface helps requesters to efficiently find out their desired service providers by providing a dynamic map for browsing of the SIC hierarchy with a sense of information space. In contrast, the traditional browsing mechanisms can only provide a series of textual lists located in several pages for navigation, which is inefficient and less comprehension. Image-Map Browser approach also has disadvantages in terms of scalability, classification scheme updating, and dynamic navigation issues. Therefore, we employ OFDAV Browser to address the above problem. The modified OFDAV Browser is capable of directly retrieving the classification information from backend database as application loaded, so the great improvement has been made in terms of efficiency and reusability.

Although the idea and the demo prototype look simple, the goal of using dynamic visualization technique for navigating large UDDI hierarchy is new and it is different from the conventional browsing methodologies. The future work includes the use of other alternative visualization techniques, such as HT-Browser [10], that are capable to display graphs with large number of nodes and the conduction of a usability study for testing our visualization technique in terms of its readability, comprehension as well as efficiency of the systems.

References

[1] K. Gottschalk, S. Graham, H. Kreger, J. Snell, "Introduction to Web Services Architecture", http://www.research.ibm.com/journal/sj/412/gottschalk.html, Nov. 2001

[2] World Wide Web Consortium (W3C), "Simple Object Access Protocol (SOAP) 1.1", http://www.w3.org/TR/SOAP/, May 2000

[3] World Wide Web Consortium (W3C), "Web Services Description Language (WSDL) 1.1", http://www.w3.org/TR/wsdl, Mar. 2001

[4] UDDI Organization, the document about UDDI, http://www.uddi.org/

[5] North American Industry Classification System (NAICS), the document about NAICS, http://www.naics.org/

[6] United Nations Standard Products and Services Code (UNSPSC), the document about UNSPSC, http://www.unspsc.com/

[7] ISO 3166, the document about ISO 3166, http://www.din.de/gremien/nas/nabd/iso3166ma/

[8] Biao Jiang, Mao Lin Huang, "Creating a Visual Interface for Large UDDI Business Registries", *Proceedings of International Multiconferences in CS & CE*, June 2003

[9] Mao Lin Huang, Peter Eades, Junhu Wang, "On-line Animated Visualization of Huge Graphs using a Modified Spring Algorithm", *Journal of Visual Languages and Computing*, Vol. 9, No. 6, 1998, pp.623-645

[10] J. Lamping and R. Rao, "The Hyperbolic Browser: A Focus + Context Technique for Visualizing Large Hierarchies", *Journal of Visual Languages and computing*, Vol. 7, No. 1, 1995, pp.33-55