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Web Services and Standard Content Planning for Graduate Curriculum

Ming Zhu[1], Jing Li[1,*], Feilong Yu[1]

[1]*College of Computer Science and Technology, Shandong University of Technology, Zibo, Shandong, China*
[*]*Corresponding author*

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Abstract: Web Services and Standards, as a graduate course, play a crucial role in cultivating graduate students and are also the foundation of many other courses. A good curriculum is beneficial for improving students' professional abilities and horizons, while also allowing them to enhance their competitive advantage and have more abilities to compete with others in future work. A good course content arrangement can help students quickly grasp the knowledge they have learned and leave a deeper impression. As a researcher, graduate students need to possess excellent research and knowledge learning abilities. Only by fully learning and gaining a deeper understanding of the content that needs to be studied can they have the opportunity to achieve certain results in this field. Compared to undergraduate students, graduate students need a deeper understanding of theoretical knowledge and apply it to practice, which is also the most crucial aspect of knowledge learning. In order to improve the learning efficiency and enhance the learning effectiveness of graduate students, this article provides a detailed introduction to the main teaching content included in the course "Web Services and Standards", including knowledge related to network services and web service composition. At the same time, this article also introduces the service quality of web services, which allows students to know where and how to use web services after learning them.

1. Introduction

"Web Services and Standards" is a very important course that graduate students need to learn at the beginning of their enrollment stage. Learning this course has a good auxiliary effect on subsequent research and learning other courses, and can also help graduate students quickly understand this type of research direction and improve their research ability. The fundamental purpose of course design is to enable students to quickly learn new knowledge and establish a foundation for the direction of Web services Research interest, providing students with the best learning environment in a favorable experimental environment and strong teaching staff.

In the context of globalization, graduate education also needs to move towards internationalization, and cultivating a new generation of graduate students with rich creativity and excellent personal abilities has become the training goal of various universities. Therefore, we must

cultivate international talents [1,2]. Course construction is the key to cultivating postgraduates' academic quality and ability [3,4]. A good curriculum is crucial for graduate students to cultivate these two abilities, at the same time, curriculum internationalization is of great significance to realize the internationalization of graduate education and cultivate international talents. Compared to undergraduate students, graduate students need a deeper understanding of theoretical knowledge and apply it to practice, which is also the most crucial aspect of knowledge learning. The arrangement of course content is very important for graduate students' learning. Reasonable arrangement of learning content can help students learn knowledge faster and make their memory of knowledge points more profound. In order to improve the learning efficiency and enhance the learning effectiveness of graduate students, this article provides a detailed introduction to the main teaching content included in the course "Web Services and Standards". This can help them quickly understand the course, and improve their professional skills and communication skills.

In this article, section 2 introduces the basic knowledge related to Web services, laying the foundation for subsequent learning; Section 3 describes the methods of Web service composition and the connection between services; Section 4 introduces the non-functional attributes (QoS) of web services to better differentiate services; Finally, we summarized in Section 5.

2. Web Service

2.1. The Introduction of Web Service

Web service are applications that perform specific tasks, which are published, located, and used on the network through Simple Object Access Protocol(SOAP), and can be accessed over the network through communication protocols. Web service is a low coupling software module that supports machine to machine interaction between different networks, and has the characteristics of independence, discoverability, reusability, composability, and transparent location. The most basic parameters of a web service are input parameters and output parameters [5]. A web service can only be awakened when all input parameters are met.

Web services are described using Web Services Description Language (WSDL) and registered through Universal Description, Discovery, and Integration (UDDI). After users find a document that describes service information using WSDL through UDDI, they can perform a series of corresponding operations in the web service through SOAP. WSDL, UDDI, and SOAP are written using the XML (Extensible Markup Language) language.

- XML is the language used for text documents or data, mainly used on the World Wide Web, and is the constituent language of SOAP. Unlike Hyper Text Markup Language (HTML) predefined tags, XML uses custom tags to store, search, and share data, primarily for short-term temporary data processing.
- The language format of WSDL is XML, which is a document used to describe a set of SOAP messages, including defining Web service and how to call them. Define Web service including input and output parameters, call location, and interface information, and provide a way to exchange the above messages. In most cases, WSDL are generated and used by the software itself.
- UDDI uses XML language to encapsulate data, and uses SOAP to publish, edit, browse, and search information in the user registry. UDDI can send various types of data to the service registry, and can also receive the required data returned by the service registry.
- SOAP is a widely used protocol in communication of web services, written in the XML language to perform service calls. SOAP provides a series of strict methods for applications using different operating systems and programming languages to communicate with each other.

Web services perform encapsulated business functions such as:

1) A self-contained business task - a funds withdrawal or fundsdeposit service;

2) A full-fledged business process - the automated purchasing ofoffice supplies;

3) An application - a life insurance application or demand forecastsand stock replenishment; or

4) A service-enabled resource-access to a particular back-enddatabase containing patient medical records.

Different companies have different definitions of web services. Microsoft regards Web services as the core of .NET, and defines Web services as Web components that can be programmatically accessed through standard Web protocols. Web services are the core of the entire .NET project and a standard for remote access. Its advantage is cross platform (because the HTTP and SOAP protocols used by Web services are common protocols on the Internet); Secondly, it can solve the problem of firewalls (web services based on the SOAP protocol can penetrate firewalls). Sun believes that Web services are the internet. The Chairman of Sun Corporation stated that intelligent Web services are of great significance for the information age, and their role is just like the key role played by replaceable standard components in the industrial age. Web services are suitable for any type of Web environment. The consumer of a Web service can be an individual, an application, or even another Web service. The characteristics of Web services are as follows:

(1) Web services can be accessed and accessed through the Web.

(2) Web services provide an XML interface.

(3) Web services use XML and standard Web protocols for communication.

(4) Web services support loose coupling connections between systems.

2.2. The Architecture of Web Service

The web service architecture consists of three parts [6]:

(1) Service Provider: The service provider is equivalent to Web service providers, who is the executors of Web services. It is responsible for planning, designing, implementing, and debugging web services, publishing usable services to the service registry, including service interface descriptions, service invocation locations, and responding to their own service requests upon receiving them.

(2) Service Requestor: The service requestor is equivalent to the consumer of a Web service, sending demand information in SOAP format to the service registry, searching for available web services in the registry, obtaining information on how the target service is called, and then using this information to call the web service provided by the service provider.

(3) Service Register: The service register provides a platform and serves as a manager in the entire architecture, including two components: service agents and knowledge bases. Among them, the service proxy is responsible for registering and publishing web services, placing service requestors and their required web service providers together, serving as a bridge connecting service requestors and service providers; Knowledge inventory stores and displays web service information provided by service providors, and classifies and searches for registered services.

The relationship between the three parts of the web service architecture is shown in Figure 1.

Each entity in the web service architecture is composed of one or more of the three roles: service provider, service requester, and service registry. Implementing a complete web service, the web service architecture has the following three operations:

(1) Publish. Service providers plan, design, and implement Web services. After debugging the web services, they use WSDL to publish the available services in the service registry, showcase the functions and interfaces of the web services to the outside world, and register them using UDDI.

(2) Find. The service requester sends information to the service registration center to request the service. After receiving this information, the service center queries the information in UDDI to find Web services that meet the needs of the service requester. After the service registration center finds

the appropriate Web service, it returns the description information in the form of WSDL to the service requester.

(3) Bind. Based on the WSDL returned by the service registry, a corresponding SOAP message is generated through processing and sent to the service provider. The service provider invokes the corresponding service based on the received message and returns the result to the service requester.

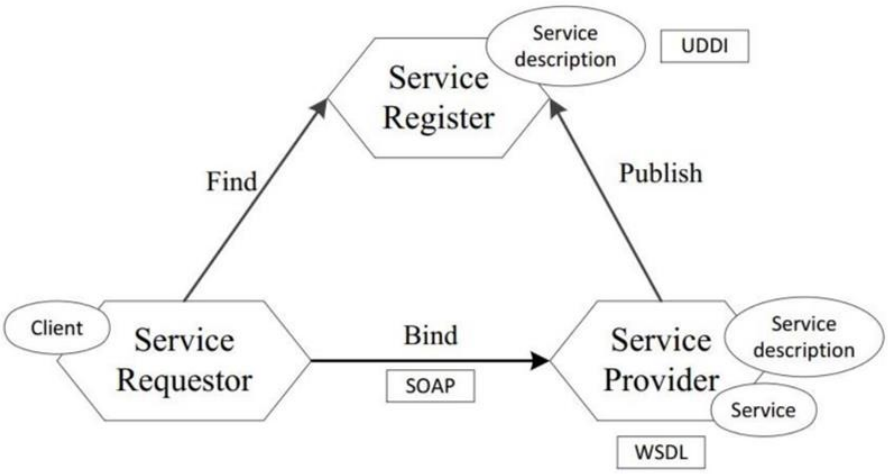

Figure 1: Architecture of Web Services

3. Web Service Composition

With the increasing maturity of Web service, more and more shared Web service have emerged on the network. However, the functionality that a single Web service can achieve is limited, and sometimes a single service on the network cannot meet the complex needs of users. More and more people need more complex and functional web services. Web service composition selects multiple Web services with different functions according to needs and combines them, which can more fully utilize shared web services and meet users' more complex needs [7].

Web service composition is to filter existing web services on the network based on the user's target needs, select Web services that meet the requirements, and with the cooperation of the platform, jointly complete service requests according to specific rules. The problem of Web service composition is to semantically match the input parameters and output parameters defined in a WSDL file. Simply put, Web service composition is the combination of different Web services to achieve more complex functions and meet the needs of users. In the absence of a single Web service that can satisfy a request, a Web service combination can satisfy specific inputs and outputs.

In Web service composition, business requirements are represented as composite request C, which is a set of parameters: input C_{in} and output C_{out}, where C_{in} is a set of input parameters and C_{out} is a set of output parameters. The task of Web service composition problem is to identify a set of Web services, where the output parameters of one Web service can be used as part of the input parameters of another Web service. These Web services can form a directed graph, and the input and output parameters meet the requirements of service composition. The parameters in the Web service composition match the semantics defined in the OWL file. If the output parameter C_1 of Web service w_1 is included in the input parameter C_2 of another web service w_2, then w_2 can use C_1 as the input parameter. As shown in Figure 2, $C_1=\{C\}$, $C_2=\{B, C\}$, then w_2 can use C_1 as a part of the input.

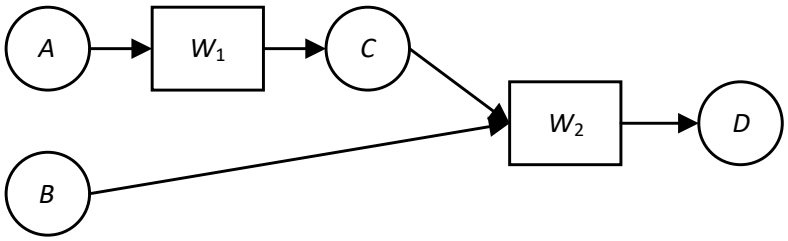

Figure 2: An example of web services composition process

There are four connection methods for web services: sequential connection, parallel connection, selective connection, and circular connection [8].

- Sequential connected services are awakened one after another.
- Parallel connected services are awakened in parallel.
- Choosing a connected service is selecting a service to wake up.
- Circular connected services refer to services that execute in a loop from w_i to w_j under certain conditions.

4. Service Quality of Web Services

Table 1: Common QoS parameters of the data set

Name	Describe	Unit
Response Time	The interval between sending a request and receiving a reply	ms
Throughput	The ratio of total calls per unit time	Times/s
Reliability	Ratio of incorrect messages to total messages	%
Usability	The ratio of successful calls to total calls	%
Success rate	Response times and total number of requests	%
Compliance	The degree to which a WSDL document follows the WSDLspec	%
Best Practicality	The degree to which web services follow WS-I configuration	%
Time Delay	The time the server takes to process a given request	ms
File	Measuring Document Integrity in WSDL	%
WsRF	Evaluation of web service related functions	%
Service Level	The level representing service quality	1-4
Service Name	The name of the web service	Null
WSDL Address	The Address of Web Service Definition Language on the Web	Null

Firstly, the web service composition should be able to achieve the functions that users need, which must meet the functional attributes. With the increasing maturity of web service technology, there are many Web services with similar functions on the network. On the premise of meeting the functional requirements of the service, researchers have begun to consider the non-functional attribute of the service - QoS. QoS represents the quality of service and is a comprehensive indicator used to reflect the capabilities of Web services. Service Level Agreement (SLA) is often used as an agreement between service requesters and service providers. Without considering QoS, planning graph algorithms typically search for the shortest combination, which typically represents shorter execution time and lower cost. Considering QoS attributes, longer plans may have faster response time, lower costs, or higher throughput, so the shortest plan may not be the preferred choice. Therefore, it is necessary to modify the classic planning algorithm to find a set of solutions with better QoS and achieve the given SLA. The QoS optimization problem of web services is a typical NP problem, which is a non-deterministic problem [9].

QoS attributes can be both positive and negative. The higher the positive QoS attribute value, the better the quality of the service, such as throughput. The higher the negative QoS attribute value, the worse the quality of the service, such as response time and price. Usually, two services are

considered the same if they have identical input and output parameters, preconditions and effects, as well as QoS attributes such as execution cost, execution time, and reliability. Table 1 lists common QoS parameters [10].

There is no unified standard for the description statement, measurement unit, and value range of QoS attributes, so it is not possible to compare QoS attributes horizontally. Normalizing QoS attribute values can effectively solve this problem. Without changing the original distribution of QoS, the normalization operation performs a linear transformation on the original data, mapping the resulting values onto the [0,1] interval.

5. Conclusion

Good curriculum construction can minimize the cost and maximize the return for teachers' teaching and students' learning. In today's rapidly developing era, students receive good nutrition from a young age, so today's students may be smarter than their predecessors and have a stronger ability to learn knowledge. Compared to undergraduate students, graduate students have a stronger ability to learn knowledge and explore problems. Therefore, it is particularly important to cultivate students' enthusiasm and enthusiasm for learning. In this article, we first introduce Web services, allowing students to have a clear understanding of what they have learned, laying a solid foundation, and providing guarantees for future learning; Secondly, it describes the composition of Web services, which helps to understand when and where the learned Web services can be used, allowing students to combine their theory and practice, thereby stimulating learning enthusiasm; Finally, the quality of service (QoS) of Web services was introduced, which can help students understand deeper knowledge about services and explore further and deeper directions. Through the gradual design of the course content, students can understand from the most basic point of view, and gradually deepen their research. Next, they need to apply the content of Web services they have learned to cloud computing and edge computing to facilitate the development of more practical applications.

References

[1] Banya K. (2010). Globalisation and Higher Education Policy Changes. The Politics of Education Reforms, 9, 55-73.

[2] Horta H. (2009) Global and national prominent universities: internationalization, competitiveness and the role of the State. Higher Education, 58, 387-405.

[3] Yang J., Jiao H., He W., Zhang Z. and Jiang P. (2018). Construction of Engineering Graduate Education System Based on Cultivation of Innovation and Entrepreneurial Ability. e-Learning, e-Education, and Online Training, 243, 257-265.

[4] Ashwin P. (2014) Knowledge, curriculum and student understanding in higher education. Higher Education, 67, 123-126.

[5] Abid A, Rouached M, Messai N. Semantic web service composition using semantic similarity measures and formal concept analysis. Multimedia Tools and Applications, 2020, 79(9): 6569-6597.

[6] Agarwal V, Dasgupta K, Karnik N, et al. A service creation environment based on end to end composition of web services//Proceedings of the 14th international conference on World Wide Web. 2005: 128-137.

[7] C. Ma and Y. He, "An Approach for Visualization and Formalization of Web Service Composition," 2009 International Conference on Web Information Systems and Mining, Shanghai, China, 2009, pp. 342-346, doi: 10. 1109/ WISM. 2009.77.

[8] J. Li, Y. Yan and D. Lemire, "Scaling Up Web Service Composition with the Skyline Operator," 2016 IEEE International Conference on Web Services (ICWS), San Francisco, CA, USA, 2016, pp. 147-154, doi: 10. 1109/ ICWS. 2016. 27.

[9] Chen M, Yan Y. Redundant service removal in QoS-aware service composition//2012 IEEE 19th International Conference on Web Services. IEEE, 2012: 431-439.

[10] You M A, Xin X, Shangguang W, et al. QoS evaluation for web service recommendation. China Communications, 2015, 12(4): 151-160.