

A Comparative Study of Testing Semantic Web Services

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Abstract

Since the web services cause time and cost reduction, these mechanisms generate the ability of reusability. Appending semantics to Web Service Description Language (WSDL), we achieve automatic tests for web services. Therefore, automated test is required to test web services is created by adding semantics to Web Service Description Language (WSDL). We verify a review and conduct test selection techniques. This paper reviews and compares different methods of testing such as Pair-Wise Test (PWT) and Orthogonal Array Test (OAT). Pair-wise testing approach is a software technique that generates variants of test including all combination of input variables. For example, the selection of regression test has a trade-off between restarting time cost and lessening the faults through the implementation of software changes. Plenty of research goals are achieved to acceptable cost for regression test⁵, e.g. selecting regression test for application, selecting regression test-based on code changes and specification.

Keywords: Orthogonal Array, Pair-Wise, Semantic Web, Test

1. Introduction

Web services as remote applications in Service-Oriented Architecture (SOA) require data evaluation. Two sets of data exist for web services. First, data is checked by services (as remote macro functions) if they are capable to generate expected outputs. The second is the description of web services in discovery and synchronization with combination of automatic systems performing user's goal⁶. Semantics as an add-on description of web services can be used for specifications of describing function. Semantic web services describe input, output, precondition, post-condition and the effect of the service. Input and output describe information transformation by the system. Preconditions and effects describe world-state changes. Precondition is the state of the world before the service execution. Effect is the description of the world generated by the service invocation.

Through the use of semantic web services, web is capable to respond to people's requirements as well

as machine's requests. Existing WSDL standard has syntactical level capabilities⁶. Web services remove compatibility problems between communications and the internet, WSDL is utilized as a mediator between multi-language systems. Semantic web services are important elements of semantic web, therefore testing web service is considered⁸.

The following part is about the related studies in this arena. In part 3, different test methods are compared. At the end, there is a conclusion.

2. Related Work

One of the problems of the web services is the need for a service to test them, not a system to simplify its complications, while users do not have access to the source code. E.g. Xiaoying Bai et al. studied ontology based test model for web services using partition technique test¹⁰. Tim et al. represented a combination of semantic web services using UML and OCL¹¹. Animeh and Atul et al.

applied AWSCM tool in web service’s regression test and obtained reduction test and they also conducted web service test with the WSDL analysis to DWSL, UWSDL, RWSL and CWSL³. William and Sergiy et al. showed the effectiveness of pair-wise testing with Boolean inputs, utilizing fault evaluator and categorized five faults and assessed the effectiveness on them⁴. M. Shaban and Gillian et al. represented test case based on requirement of semantic web service using model checking approach to categorize tests². Dengshan et al. recommended layered approach in web application⁷. Chugan and Fei et al. verified semantic manner and applying SXM machine virtual information for testing web services⁹. A measure called F-measure considered by Chen et al, counts the number of test cases required to detect the first failure¹³. Weyuker¹⁴ suggested two measures of effectiveness based on the probability that one randomly taken test set will detect a fault.

3. Materials and Methods

In this part different test methods are compared. These methods include: Orthogonal Array Test (OAT) and Pair-Wise Testing Technique (PWT).

3.1 Orthogonal Array Test (OAT)

OAT test is a methodical and arithmetical test technique of black box to test the softwares¹². It is used when the number of inputs is limited¹, but it gives big domain coverage for every possible input to systems. This test can be utilized for testing mediator user, system, efficiency test and implementation. Every vector carries unique different information without any appendix in a sequence. Each vector is also statistically independent, for example the correlation between them equals null. X and Y are two vectors; V can be orthogonal if its value equals zero¹⁶.

There is a system with three parameters each of which gets three values. In order to test all possible combinations of these parameters (e.g. a comprehensive test), we have a test group of $3 \wedge 3 = 27$, but instead of testing the system with a combination of these parameters, we utilize an orthogonal array for selecting a subdivision of these combinations. Implementing orthogonal array test, we can optimize the test coverage, while minimizing the stages of the test is desired.

Table Test cases and differences parameters

Orthogonal Array			
Test case ↓	Parameter 1	Parameter 2	Parameter 3
1	1	1	3
2	1	2	2
3	1	3	1
4	2	1	2
5	2	2	1
6	2	3	3
7	3	1	1
8	3	2	3
9	3	3	2

Table shows a group of 9 parameter combinations that are appropriate for finding the faults.

- Single mode fault: This mode occurs only for one parameter. E.g. if the orthogonal array had faults in the stages of 7, 8 and 9, we can expect a fault in 3 values of the parameter 1.
- Double mode faults: This fault has occurred by a reaction of two specific parameters. This kind of reaction is harmful for correlated parameters.
- Multimode faults: If more than two faulty output components are constantly produced, this is called Multimode faults, that Orthogonal Array can identify that.

Making a virtual world in the test process based on the experiment in the necessary environment causes a reduction in the cost of equipment and the related sources, the desired time to guide the test process and increasing the ability to eliminate the infra structures.

3.2 Pair-Wise Testing Technique (PWT)

It is a synthetic test of software which tests all discrete parameters for each pair of input parameters to the system (Typically, n software algorithm). Selecting test vectors carefully increases the speed of comprehensive search of all combinations of the parameters.

It is assumed that the performance of the test has given N parameter in a group. $\{PP\} = \{P1, P2, PN\}$

Parameters range has been given by $R(Pi) = ni$ i. we assume = $ni |Ri|$

It should be noted that the group of selected ranges $x = \{ni\}$ can be in the form of multiset because some parameters can have the same values. Now Max(s) is specified as the maximum multiset¹⁷.

Then the number of stages of PW on the test performance equals: $T = \text{Max}(x) \times \text{Max}(x \setminus \text{Max}(x))$

In simple words, it means if $n = \text{Max}(x)$ and $m = \text{Max}(x \setminus \text{Max}(x))$, then the number of tests equals $O(nm)$. N and m are the number of possibilities for both parameters with the highest selection¹⁵.

In this way parameters with selected range of 2, with the selected kind of 3 and category 4. This means $x = \{2, 3, 4\}$ because $n = 4$, $m = 3$, the number of tests equals 12.

3.3 Object Constraint Language (OCL)

OCL is a formal language for describing expressions in UML method. Constant conditions cleared by expressions that should save system being modeled or described object query in model.

4. Discussion

This article tries to investigate and compare the different testing techniques including OAT and PWT. The result of the study is conducted by Askarunisa et al.

Test runs illustrate that for OAT and PWT is the same for dissimilar levels for Factor 3. For ex, Factor (2,1) and Level (2,10) income that two parameters take two different values while the third parameter takes 10 different values. Comparing PWT and OAT runs for a variety of strength shows that OAT runs required for strength 2 is lesser compared to PWT, whereas OAT runs increase with strength. The number of test cases more in OAT technique than the PWT techniques. OAT considers more mixtures than PWT techniques. With the increase in levels, OAT technique needs lesser amount of test cases than the PWT. Based on our consideration OAT is most favorable technique for additional number of parameters.

5. Conclusion

In this article, different methods of testing semantic web services were investigated and compared different test techniques for reduction. According to the recent studies, when the parameters of PWT decrease, it is more effective, on the contrary, when the input parameter increases, it is a better technique to test OAT. Moreover, the PWT technique is better than the comparison of OAT and it has less utilization time.

6. References

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