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WEB SERVICE SUBSTANTIATION: A SURVEY

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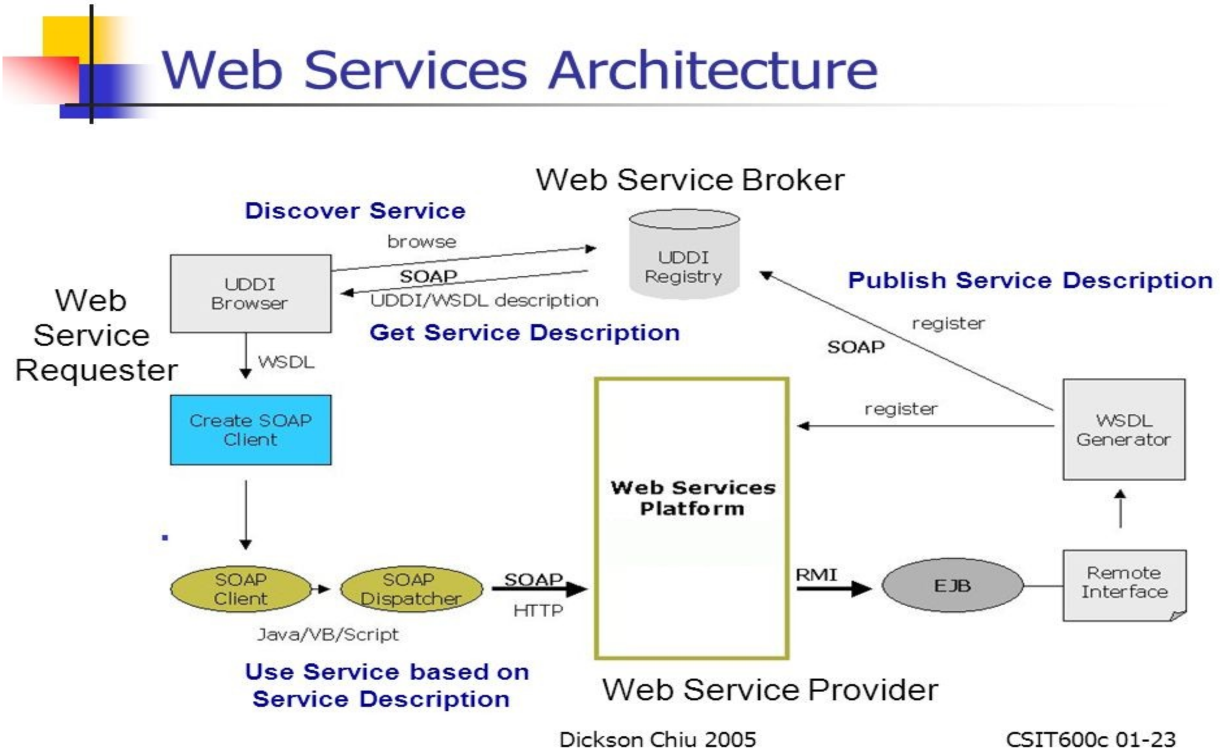
Abstract

A Web service is defined as a computational entity accessible over the internet using web service standards and protocols. Web Service Testing has become a necessity in the recent times as higher level complex applications are developed and testing is needed to debug and to deliver the product in the highest achievable quality. There are several testing strategies in place today like Regression and Robustness testing which are very effective, but they have a truckload of disadvantages associated with them. There are several other mechanisms as well which would yield great results with a lesser rate of issues. We have documented and surveyed several testing mechanisms to distinguish the best testing methodologies from the average testing methods. If the best testing strategies and methodologies has been proposed, it would help the testers ensure that the project tested is devoid of bugs which may cause the system to deviate from the expected output and that the whole product is of the highest quality.

Introduction

Internet is a world wide web which is the main source for the web services. A web service is a method of communication between two electronic devices over the web (internet). Millions of web services are published across the internet which can be made use of, according to the requirements of the consumers. These services might be available as WSDL files or sometimes the services might be available directly. The increasing popularity of web services can be attributed to a movement towards service-oriented architecture (SOA). Web service testers are facing great challenges interesting Web Services (WS) especially when integrating to services owned by other vendors. They must deal with the diversity of implementation techniques used by the others services and meeta wide range of test requirements. In our proposed framework, the web services to be tested are handed over to the WS Test Manager for testing. As per the Service Level Agreement Profile, the service consumers provide the test requirements to the WS Test Manager. The WS Test Manager has access to the Service Registry, WSDL Set, QoS repository, OWL Set and Audit Log to perform the Functionality and Non-Functional Testing of the Web services. Under Functionality Testing, Input Output test and Dependency tests are performed using XML DOM and Ontology. Under the Non-Functional Testing, an Ontology Model is created comprising of a few testable QoS parameters which are measured using various tools. The dependencies between these parameters are mapped onto the ontology and the deviation of the service performance is computed. A final Test Report consisting of test and analysis results will be given back to the test requestor.

ARCHITECTURE OF WEB SERVICE



A Web Service is a standards-based, language-agnostic software entity that accepts specially formatted requests from other software entities on remote machines via vendor and transport neutral communication protocols producing application specific responses. Benefits of web services are LooselyCoupledEachserviceexists independently of the othersservicesthat makeuptheapplication.Individualpiecesofthe application

To be modified without impacting un related areas .EaseofIntegration Dataisisolatedbetweenapplicationscreating'silos'. Web Services actasgluebetweentheseandenable easier communicationswithinand acrossorganization.Service ReuseTakescodereuseastepfurther. Aspecificfunctionwithinthe domainisonlyevercodedonceandusedoverand overagain byconsumingapplications.The simplest Web service system has two participants:

A service producer (provider)
The provider presents the interface and implementation of the service and the requester uses

the Web service as shown in Fig.1.1

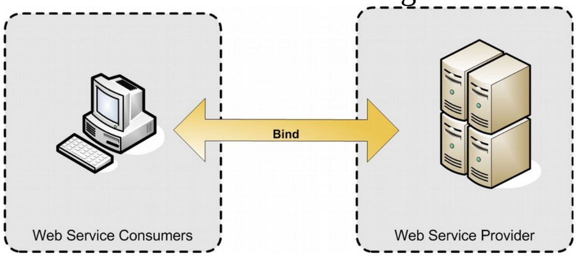


Fig 1.1: Web service System with two participants

Service Oriented Architecture (SOA)

Service-oriented architecture (SOA) is a software design methodology based on structured collections of discrete software modules, known as services that collectively provide the complete functionality of a large or complex software application. Each service that makes up an SOA application is designed to provide a tightly defined set of functions. A registry, acts as a broker for Web services. A provider can publish services to the registry a consumer; can then discover services in the registry.

This architecture is shown in below Fig.1.2

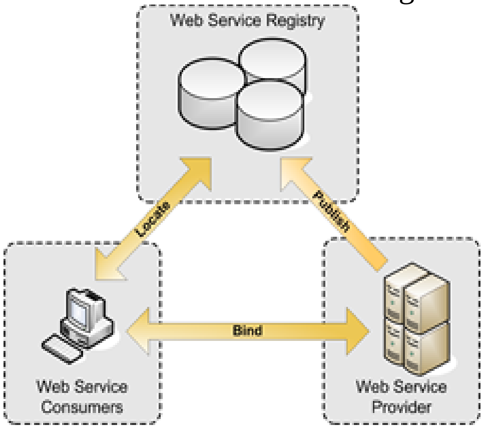


Fig.1.2: SOA Architecture

Simple Object Access Protocol

SOAPisanindustryacceptedW3Cspecification foraubiquitousXMLdistributedcomputing infrastructure. It is a mechanismfordefiningtheunitof communication and forerrorhandling. It is anextensibilitymechanism. It lives above the transport layer. Simply put it's a mechanism that allows the transmission of XML documents regardless of transport layer protocol.

WebServicesDescriptionLanguage (WSDL)

WebServicesDescriptionLanguage (WSDL) isanXMLformatfor describingalltheinformationneededtoinvokeandcommunicate withaWebService.Aservicedescriptionhastwomajor components

FunctionalDescription

Defines the detailsohowtheWebServiceisinvoked andwhereit is invoked.It focuses onthedetailsofthesyntaxofthemessage andhowtoconfigurethenetwork protocolstodeliverthe message.

Non-functionalDescription

Providesotherdetailsthataresecondarytothe message (suchassecurity policy) butinstructthere requestor'sruntime environment ToincludeadditionalSOAPheaders.

UDDI

Universal Discovery Description and Integration acts as the yellow pages of Web services. As with traditional yellow pages, you can search for a company that offers the services you need, read about the service offered and contact them for more information. You can offer a Web service without registering it in UDDI, just as you can open a business in your basement and rely on word-of-mouth advertising but if you want to reach a significant market, you need UDDI so that customers can find you.

A UDDI directory entry is an XML file that describes a business and the services it offers.

There are three parts to an entry in the UDDI directory. The "white pages" describe the company offering the service: name, address, contacts, etc. The "yellow pages" include industrial categories based on standard taxonomies such as the North American Industry Classification System and the Standard Industrial Classification. The "green pages" describe the interface to the service in enough detail for someone to write an application to use the Web service. The way services are defined is through a UDDI document called a Type Model or tModel. In many cases, the tModel contains a WSDL file that describes a SOAP interface to an XML Web service, but the tModel is flexible enough to describe almost any kind of service.

Related works

Software has becomes more important because complex defects in software can have a significant impact to user and vendors. Two decades ago, the software testing wassuch a critical part of the entire process of producing high quality software that an industry devoted as much as 40% of its time on testing to assure the quality of the software product. The mix of mark up, presentation and programming languages is used to create a web application and it possess additional challenges for fully automated and continuous integration as test drivers.

The WWW has become an indispensable part of our society in two short decades with the rapid advancement in hardware infrastructure and software technologies. web application and software that runs on web server enable the user to interact with the browser or other software services that has grown to be so sophisticated and supports complex interaction with users.

Drawbacks in the existing system

Usageofhigh level language cannot ensure that the software is of a very quality. It has less automated activities and requires more manpower and is time consuming. It has a lot of paperwork and requires manual calculation.

Proposed system

To avoid all these limitations and make the working more accurate, the system needs to be computerized in a better way. We have proposed a new ideology of testing. In the proposed system, several authors have suggested several theories and methodologies for testing of web services and they all have some shortcomings associated with them. We are here to propose a groundbreaking theory which works by integrating several of the best methodologies by automating the test acse generation process, with a limited amount of disadvantages so that the effect of the shortcomings can be made negligible and the quality of the software can be made the highest possible.

Ontology

Ontology (the "science of being") is a word, like metaphysics, that is used in many different senses. It is sometimes considered to be identical to metaphysics, but we prefer to use it in a more specific sense, as that part of metaphysics that specifies the most fundamental categories of existence, the elementary substances or structures out of which the world is made. Ontology will thus analyze the most general and abstract concepts or distinctions that underlay every more specific description of any phenomenon in the world, e.g. time, space, matter, process, cause and effect, system. Recently, the term of "ontology" has been up taken by researchers in Artificial Intelligence, who use it to designate the building blocks out of which models of the world are made. An agent (e.g., an autonomous robot) using a particular model will only be able to perceive that part of the world that his ontology is able to represent. In this sense, only the things in his ontology can exist for that agent. In that way, ontology becomes the basic level of a knowledge representation scheme. An example is set of link types for a semantic network representation which is based on a set of "ontological" distinctions: changing-invariant and general-specific. *Ontology* is originally a branch of philosophy that deals with the nature and the organization of reality. It tries to answer questions like "what is existence", "what properties can explain the existence" etc. Aristotle defined ontology as the science of being as such. Unlike the special sciences, each of which investigates a class of beings and their determinations, ontology regards "all the species qua being and the attributes that belong to it qua being". In this sense the philosophical ontology tries to answer the question "what is the being?" or, in a meaningful reformulation "what are the features common to all beings?".This is what can be called "general ontology" - in contrast with various special ontologies for a particular domain. Such an ontology is not concerned with the existence of certain objects, but rather in the rigorous description of their forms of being, i.e., their structural features.

XML DOM

The XML DOM defines a standard way for accessing and manipulating XML documents. The DOM presents an XML document as a tree-structure. Knowing the XML DOM is a must for anyone working with XML. A better approach to retrieving information from XML files is to use an XML parser. An XML parser is, quite simply, software that reads an XML file and makes available the data in it. As a Visual Basic developer you want to use a parser that supports the XML Document Object Model (DOM). The DOM defines a standard set of commands that parsers should expose so you can access HTML and XML document content from your programs. An XML parser that supports the DOM will take the data in an XML document and expose it via a set of objects that you can program against.

Non-functional characteristics

Quality of service (QoS) is a combination of several qualities or properties of a service, such as: availability is the percentage of time that a service is operating; security properties include the existence and type of authentication mechanisms the service offers, confidentiality and data integrity of messages exchanged, no repudiation of requests or messages, and resilience to denial-of-service attacks; response time is the time a service takes to respond to various types of requests; Response time is a function of load intensity, which can be measured in terms of arrival rates (such as requests per second) or number of concurrent requests. QoS takes into account not only the average response time, but also the percentile of the response time; and throughput is the rate at which a service can process requests. QoS measures can include the maximum throughput or a function that describes how throughput varies with load intensity. The QoS measure is observed by Web services users. These users are not human beings but programs that send requests for services to Web service providers. QoS issues in Web services have to be evaluated from the perspective of the providers of Web services and from the perspective of the users of these services. The dynamic e-business vision calls for a seamless integration of business processes, applications, and Web services over the Internet. Delivering QoS on the Internet is a critical and significant challenge because of its dynamic and unpredictable nature. Applications with very different characteristics and requirements compete for scarce network resources. Changes in traffic patterns, denial-of-service attacks and the effects of infrastructure failures, low performance of Web protocols, and security issues over the Web create a need for Internet QoS standards. Often, unresolved QoS issues cause critical transactional applications to suffer from unacceptable levels of performance degradation. With standards like SOAP, UDDI, and WSDL being adopted by all major Web service players, a whole range of Web services -- covering the financial services, high-tech, and media and entertainment -- are being currently developed. As most of the Web services are going to need to establish and adhere to standards, QoS will become an important selling and differentiating point of these services. QoS covers a whole range of techniques that match the needs of service requestors with those of the service provider's based on the network resources available. By QoS, we refer to non-functional properties of Web services such as performance, reliability, availability, and security.

WAPT

A web application performance tool (WAPT) is used to test web applications and web related interfaces. These tools are used for performance, load and stress testing of web applications, web sites, web servers and other web interfaces. WAPT tends to simulate virtual users which will repeat either recorded URLs or specified URL and allows the users to specify number of times or iterations that the virtual users will have to repeat the recorded URLs. By doing so, the tool is useful to check for bottleneck and performance leakage in the website or web application being tested. A WAPT faces various challenges during testing and should be able to conduct tests for: Browser compatibility .Operating System compatibility Windows application compatibility where required. APT allows a user to specify how virtual users are involved in the testing environment.ie either increasing users or constant users or periodic users load. Increasing user load, step by step is called RAMP where virtual users are increased from 0 to hundreds. Constant user load maintains specified user load at all time. Periodic user load tends to increase and decrease the user load from time to time. WAPT is a load and stress testing tool that provides an easy-to-use and cost-effective way to test any web site, including business applications, mobile sites, web portals, etc. With WAPT you can create load tests in a matter of minutes. A few clicks are required to make thousands virtual usersexecute concurrent sessions against your web site. The product supports testing of RIA applications in the data-driven mode. Itworks with secure HTTPSpagesandall types of authentication. Descriptive graphs and reports will let you analyze the performance characteristics of your system components under various load conditions, isolate and fix any bottlenecks and optimize your software and hardware configuration. WAPT is designed to generate maximum possible load on your web site that you are testing. While most other similar tools also offer this ability, what makes WAPT impressive is its ability to use a number of techniques to make this load as similar as possible to the activity of real users browsing the web site in real life. This unique approach ensures that if your tests are passed, you can safely assume that the web site under test will show similar performance characteristics in real-time usage.

Testing tool

SoapUI

SoapUI is an open course, cross platform testing tool. It can be automate functional, regression, compliance and load testing of both SOAP and REST web services. It comes with an easy to use GUI and supports industry leading technologies. It allows developing own set of features and supports WS security and decryption.

TestingWhiz

TestingWhiz is a codeless test automation tool which comes with API web service testing capability. It helps to perform end to end testing right from web UI, business logic to database and ETL without coding needs. It lets you perform functional, compliance, load testing and mocking of REST and SOAP web service via WSDL. It supports data driven and key driven data testing.

SOAPSonar

SOAP Sonar provides a comprehensive web service testing for HTML, XML, SOAP, REST and JSON. It provide functional, performance, compliance, interoperability and security testing with out of box support. It support vulnerability test with XSD-Mutation and integrate with HP quality center. SOA test is an enterprise grade tool by parasoft for testing and validating APIs and API driven apps. It provides robust support for the functional unit, integration security, simulation, mocking, compliance and load testing for technologies .It supports continuous integration testing and helps to create sophisticated extensible and reusable test without coding.

Research directions

Testing plays a significant role in web services. In case of using generic testing algorithms for testing web services, they are tested only for basic functionalities and not for application specific usage. Testing a large complex application using a simple testing algorithm might result in several bugs or errors go undetected, which in turn results in a lower quality of an application performance too. If the following testing strategies is applied, will yield results with good performance.

- Control flow analysis of the web service
- Capturing the behaviour of WS
- Automatic generation of test cases
- Testing using integrated automated testing tools using a newly found algorithm

Discussion

Testing of Web Services is a theoretical concept at best and several complex tools are required for implementation. Our proposal aims at creating a new tool or a product which would supposedly integrate several automated tools into a single integrated component into which the Web service to be tested in loaded and the corresponding actions will be performed . The product integrates several automation testing tools which generate testing scenarios and test cases corresponding to the application. In addition to the integrated approach towards testing with tools, the control flow of the web service is described and the behaviour of the web service is captured and control flow specific testing is performed using testing tools. Thus the comparison of the two types of testing are depicted in the form of graphical representation

Conclusion

In this paper, we are on the process on devising a new product by integrating several testing methodologies to test the Web Services efficientlyby means of an algorithm. Our testing standards will ensure that the software, after testing will be of the highest achievable quality.This product is still in the development and survey stage.

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