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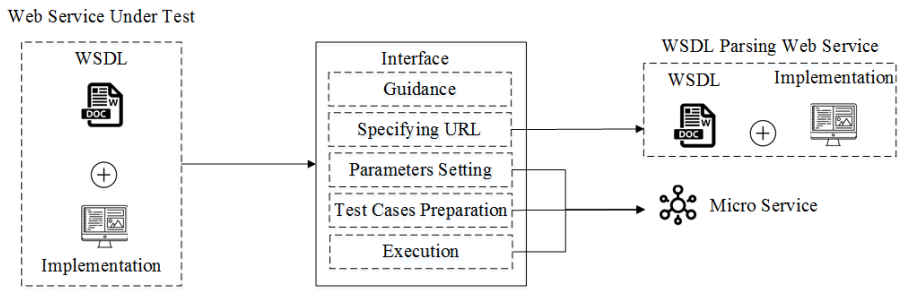
DRTester

The prototype tool *DRTester* can test web services using dynamic random testing technique. We describe the implementation and configuration of the tool in detail.

Framework of DRTester



The above figure illustrates the *DRTester* framework, comprising four main parts, corresponding to the left of web service is the testing target; *interface* is the interface between the user and *DRTester*; the top right of web service is responsible to parse the address of the target web service's WSDL, and return information (such as methods and parameters) to *micro service*s that are used to partition input domain, generate test cases, execute test case, and send information to *interface*.

We next examine each component in the framework individually.

Front-end interface

We developed a HTML page by using the Vue framework (https://cn.vuejs.org/), the source code of which can be obtained by visiting https://github.com/phantomDai/DRTester.git.

This interface wraps the setting information in the HTTP messages, and sends them to the Micro services that not only are responsible for communicating with this *interface* but also wrap the selected test cases in SOAP messages, and sends them to the web service under test.

WSDL parsing service

We can obtain the necessary information by parsing WSDL of web service under test to generate test cases and automatically invoke interested methods of web service under test. Accordingly, a web service has been developed to acquire information about the names and types of interested methods of web service under test, along with their parameters information (name and type). Besides, we also made this web service publicly accessible (https://github.com/phantomDai/parseesdlws.git).

Micro services

The back-end logic is composed of several Restful APIs (For more details, please visit linkage: https://github.com/phantomDai/drtAPI.git) and Java classes: The APIs are responsible for communicating HTTP messages to and from the front-end interface. The controller class is responsible for updating the test profile according to the test results, and for selecting test cases from the partitions. The selected test cases are wrapped in SOAP messages and sent to the web service under test through the proxy class, which also intercepts the test results.

Configuration of DRTester

This section describes the configuration of the front-end interface, Micro services, and WSDL parsing service.

Configuration for front-end interface

The users need to set up the local environment as follows:

1. download and install *node.js* (please visit linkage: https://nodejs.org/en/)
2. execute the following command in DOS (if not in China, please ignore this step):

```
npm install -g cnpm --
registry=https://registry.npm.taobao.org
```

3. execute the following command in DOS:

```
npm install vue -g
```

4. execute the following command in DOS:

```
npm install vue-cli -g
```

After the front-end environment is configured, the users can download the source code of which by visiting the linkage: https://github.com/phantomDai/DRTester.git. Next, users need to go the the root of the downloaded file, and create a directory named "node_modules". The above configuration is sufficient for uses to execute the following command in DOS.

```
npm install (if in China, please execute command: cnpm install)
```

Finally, users need to find all *post* or *get* methods in *BaseTable.vue* and *Tabs.vue*, and change the values of *url* by replacing the address of IP with uses' IP. For instance, uses should replace the following value of *url* (on the line 266 of *BaseTable.vue*)

```
url: 'http://202.204.62.171:8082/api/parse/wsdl'
```

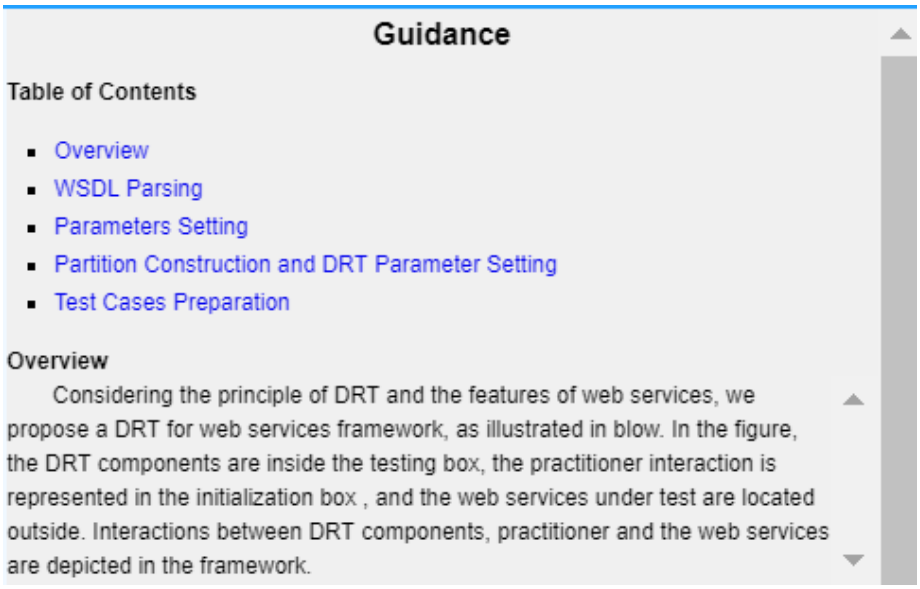
with

```
url: 'http://IP<sup>*</sup>:8080/api/parse/wsdl'
```

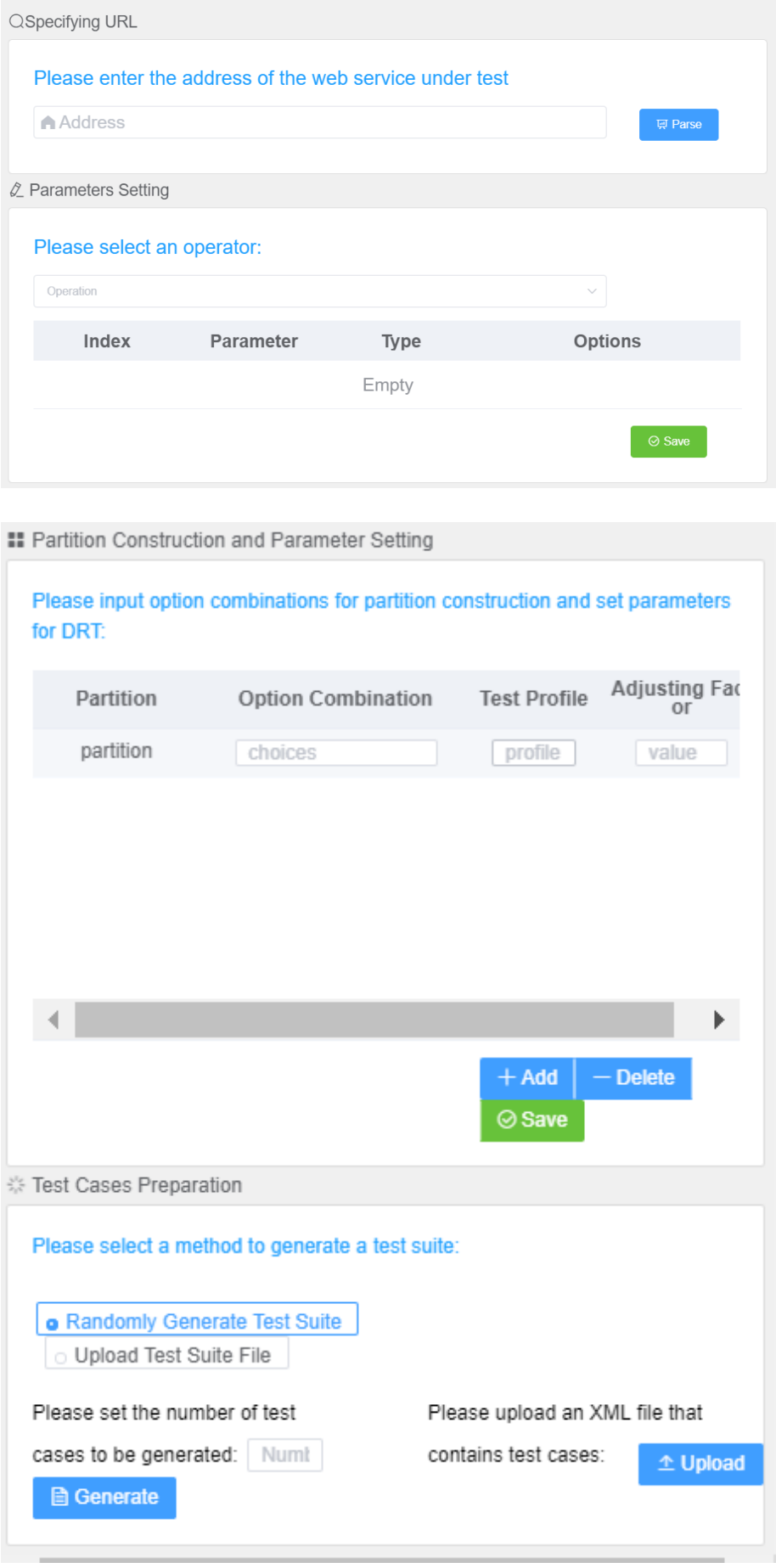
,where IP* is the address of users' IP. Finally, uses can execute the following command and input "http://localhost:8080" in their browsers.

```
npm run dev
```

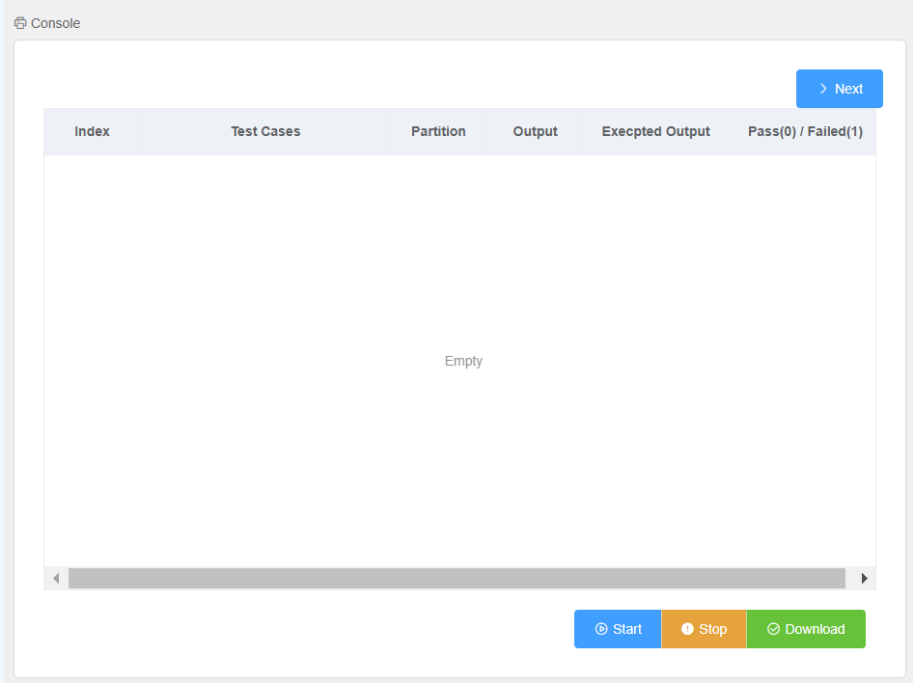
The first page of front-end interface is *Guidance* (as shown in following figure), ***where we describe the steps and rules the tester should follow when testing a web service***.



The second page of front-end interface is *Configuration* (as shown in following figures), ***where users need to provide some information to partition input domain and generate test cases***.



The third page of front-end interface is *Execution* (as shown in the following figures), ***where users can control the execution of test cases and download test report.***



Configuration of WSDL parsing service

The users need to set up the local environment as follows:

1. Tomcat 9.06 (that is available in the repository: https://github.com/phantomDai/parseesdlws.git)
2. JDK 1.8.0_161 (that is available in the linkage: https://www.oracle.com/technetwork/java/javase/downloads/index.html)
3. IntelliJ IDEA (that is available in the linkage: http://www.jetbrains.com/)

Source code of this service can be downloaded from the provided linkage, and opened by IntelliJ IDEA.

The default port of this web service is ***8085***. If changing the port of this web service, the user needs to change the the value of parameter *endpoint* in *ParseWSDL* script that can be available in linkage: https://github.com/phantomDai/drtAPI.git.

In the *parseWSDL* class, there is a member variable named *endpoint*. Users need to change the value of this variable according to their IP and above port. For instance, we set *endpoint* value according to our IP and port:

```
private static String endpoint =
"http://202.204.62.171:8085/services/parser?wsdl"
```

Configuration of Micro services

The users need to set up the local environment as follows:

1. Maven (that is available by visiting the linkage: http://maven.apache.org/)

Then, the users can execute the following command in the drtAPI directory.

```
mvn clean package  -Dmaven.test.skip=true
```

Finally, users can go to the "target" directory and execute the following command.

```
java -jar ./drt-0.01-SNAPSHOT.jar
```

Congratulations, we've configured all the necessary environments.

An example of testing web service

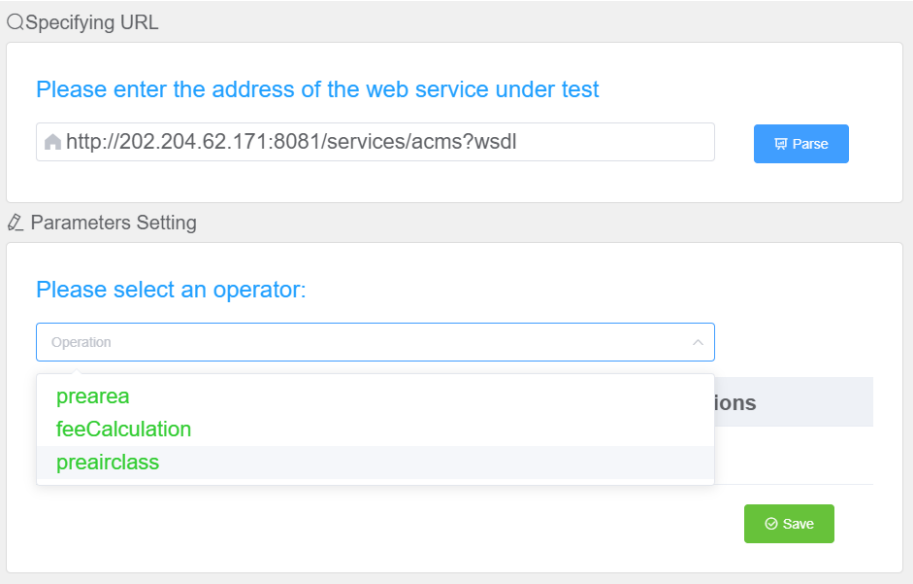
We show an example of testing web service using our prototype tool.

The specification of web service under test

Aviation consignment management service (ACMS) (that is available by visiting the linkage: https://github.com/phantomDai/drt4ws) helps airline companies check the allowance (weight) of free baggage, and the cost of additional baggage. Based on the destination, flights are categorised as either domestic or international. For international flights, the baggage allowance is greater if the passenger is a student (30kg), otherwise it is 20kg. Each aircraft offers three cabins classes from which to choose (economy, business, and first), with passengers in different classes having different allowances.

Step 1: Specifying url and setting parameters

Users first need to enter the address of the WSDL of web service under test (WSUT), and click "Parse" button, and then a method of WSUT can be selected in the following drop-down menu (as shown in following figures).



Users must partition each parameter into disjoint options, and describe them according to predefined rules that are introduced in ***Guidance*** page (as shown in the following figure). After the "Save" button is clicked, parameters and corresponding options are sent to the Mirco services.

Please select an operator:

feeCalculation

Index	Parameter	Type	Options
1	area	int	1-1:{0};1-2:{1};1-3:{2}
2	airClass	int	2-1:{0};2-2:{1};2-3:{2}
3	luggage	double	3-1:[0,60];3-2:(60,300
4	economicfee	double	4-1:{0};4-2:(0,3000)
5	isStudent	boolean	5-1:{true};5-2:{false}

Step 2: Partition construction and parameter setting

Users must partition input domain by combining options with different parameters of selected method (as shown in following figure). Besides, users need to set the selecting probability for each partition, and the value of probability adjusting factor. After clicking the "Save" button, all provided information will send to Mirco services, which are responsible for initializing test profile, setting the value of *epsilon*, and dividing input domain.

Partition Construction and Parameter Setting

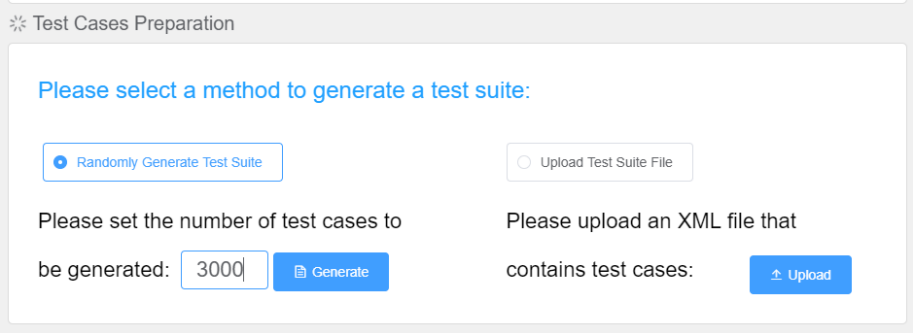
Please input option combinations for partition construction and set parameters for DRT:

Partition	Option Combination	Test Profile	Adjusting Factor
partition	2-1:{0};5-1:{true}	0.125	
partition	2-2:{1};5-1:{true}	0.125	
partition	2-3:{2};5-1:{true}	0.125	
partition	2-4:{3};5-1:{true}	0.125	0.05
partition	2-1:{0};5-2:{false}	0.125	
partition	2-2:{1};5-2:{false}	0.125	

+ Add — Delete Save

Step 3: Test case preparation

We provide two methods to generate test cases: 1) Randomly generate test cases; 2) Upload Json file that include test cases. Note that there are rules about the format of the uploaded Json file, which are described in ***Guidance*** page.



Step 4: Test case execution

After performing all the steps above, all necessary stuff for testing are ready. Users first click *start* button, then the table in the middle of page shows the information of testing. If test cases are generated using random strategy, users must decide whether the last test case detected a fault. If a test case detected a fault, the user needs to change the value of the last row and last column in the table to "1". Then, next test case is executed by click "Next" button. The "Stop" button is responsible for sending a signal which means testing task is finished. Users also can download testing report that records the information of testing process.