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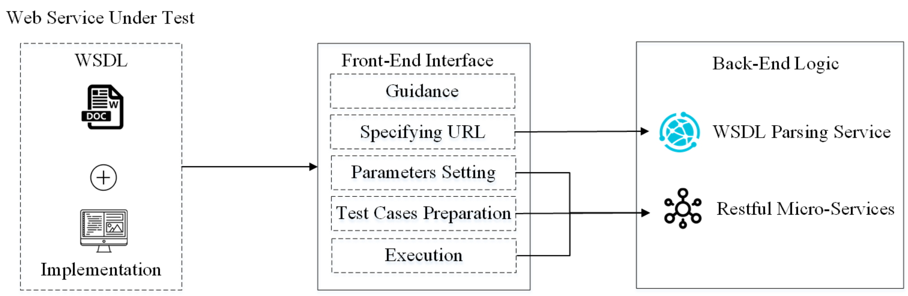
DRTester

The prototype tool *DRTester* supports dynamic random testing ~~technique~~ for web service testing. ~~We~~ describe the implementation and usage of the tool in detail.

Framework



The above figure illustrates the *DRTester* framework comprising four main components, corresponding to web service under test; the front-end interface (*interface* for short) between the user and *DRTester*; WSDL parsing service is responsible for parsing WSDL file of web service under test; and Restful micro-services that are used to divide input domain, generate test cases, execute test ~~case~~, and send information to the *interface*.

We next examine each component in the framework individually.

Front-end interface

We developed three HTML pages ~~by~~ using the Vue framework (https://cn.vuejs.org/), their source codes are available ~~by visiting~~ https://github.com/phantomDai/DRTester.git.

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

Back-end logic

In this section, we describe the implementation of back-end logic, which comprises two parts: 1) a WSDL parsing web service; 2) several Restful micro-services.

WSDL parsing service

We obtain the necessary information by parsing WSDL file 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 interested methods ~~of web service under test~~ (such as names and types of return value), along with their parameter~~s~~ information (names and types). ~~Besides, we~~ also made this web service publicly ~~accessible~~ (https://github.com/phantomDai/parseesdlws.git).

Restful Micro-Services

The Restful micro-services (For more details, please visit ~~linkage:~~ https://github.com/phantomDai/drtAPI.git) are responsible for communicating HTTP messages to and from the front-end interface. ~~Besides, these~~ micro-services need to update the test profile according to the test results, and select test cases from the partitions. The selected test cases then are wrapped in SOAP messages and sent to the web service under test through the proxy class.

Configuration

This section describes the configuration of the front-end interface and back-end logic.

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 user ~~downloads~~ the source codes ~~by visiting~~ ~~the linkage:~~ https://github.com/phantomDai/DRTester.git. Next, the user needs to go the the root directory of the downloaded file, and create a directory named "node_modules". Then the user needs to execute the following command in DOS.

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

Finally, the user needs to find all of the *post* and *get* methods in *BaseTable.vue* and *Tabs.vue*, and change the value of *url* (~~that is~~ a variable in *BaseTable.vue* and *Tabs.vue*) to replace the IP address with user's IP. For instance, the user replaces the current value of *url* (on the line 266 of *BaseTable.vue*)

```
url: 'http://202.204.62.171:8082/api/parse/wsdl' (current
IP address)
```

with

```
url: 'http://XXX.XXX.XXX.XXX:8080/api/parse/wsdl' (user's
IP address)
```

Finally, the user executes the following command in DOS and inputs "http://localhost:8080" in ~~her~~ browser.

```
npm run dev
```

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

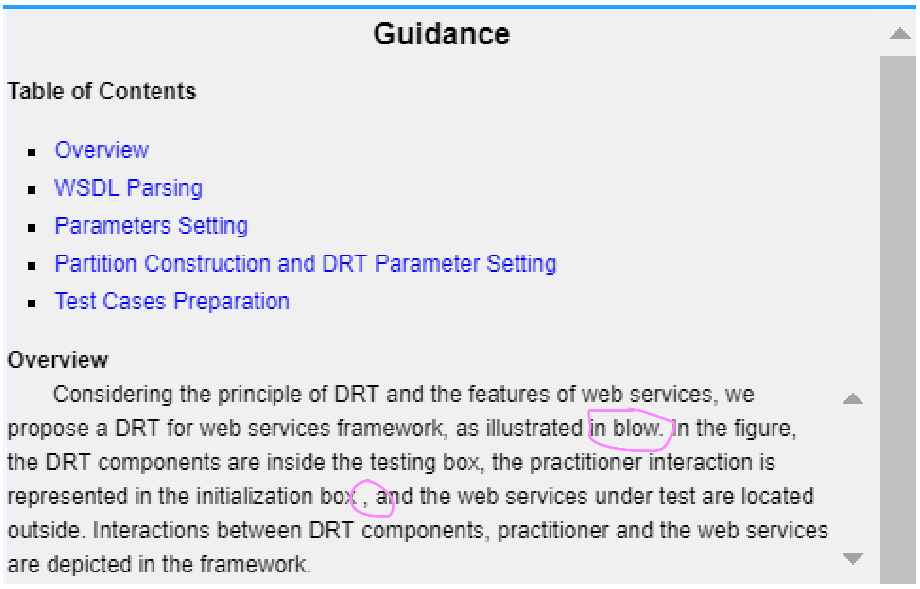

Guidance

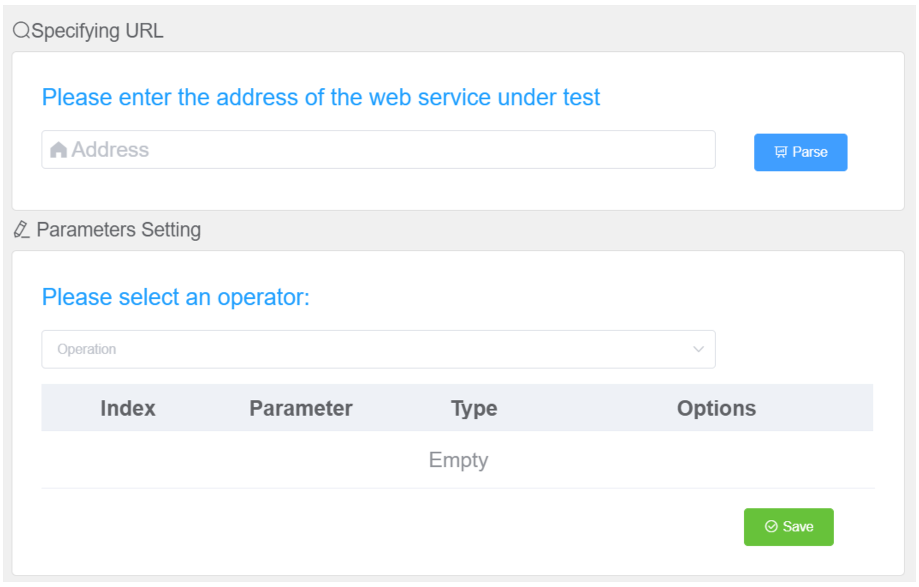
Table of Contents

- Overview
- WSDL Parsing
- Parameters Setting
- Partition Construction and DRT Parameter Setting
- Test Cases Preparation

Overview

Considering the principle of DRT and the features of web services, we propose a DRT for web services framework, as illustrated in blow. In the figure, the DRT components are inside the testing box, the practitioner interaction is represented in the initialization box , and the web services under test are located outside. Interactions between DRT components, practitioner and the web services are depicted in the framework.

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


Specifying URL

Please enter the address of the web service under test

Address

Parse

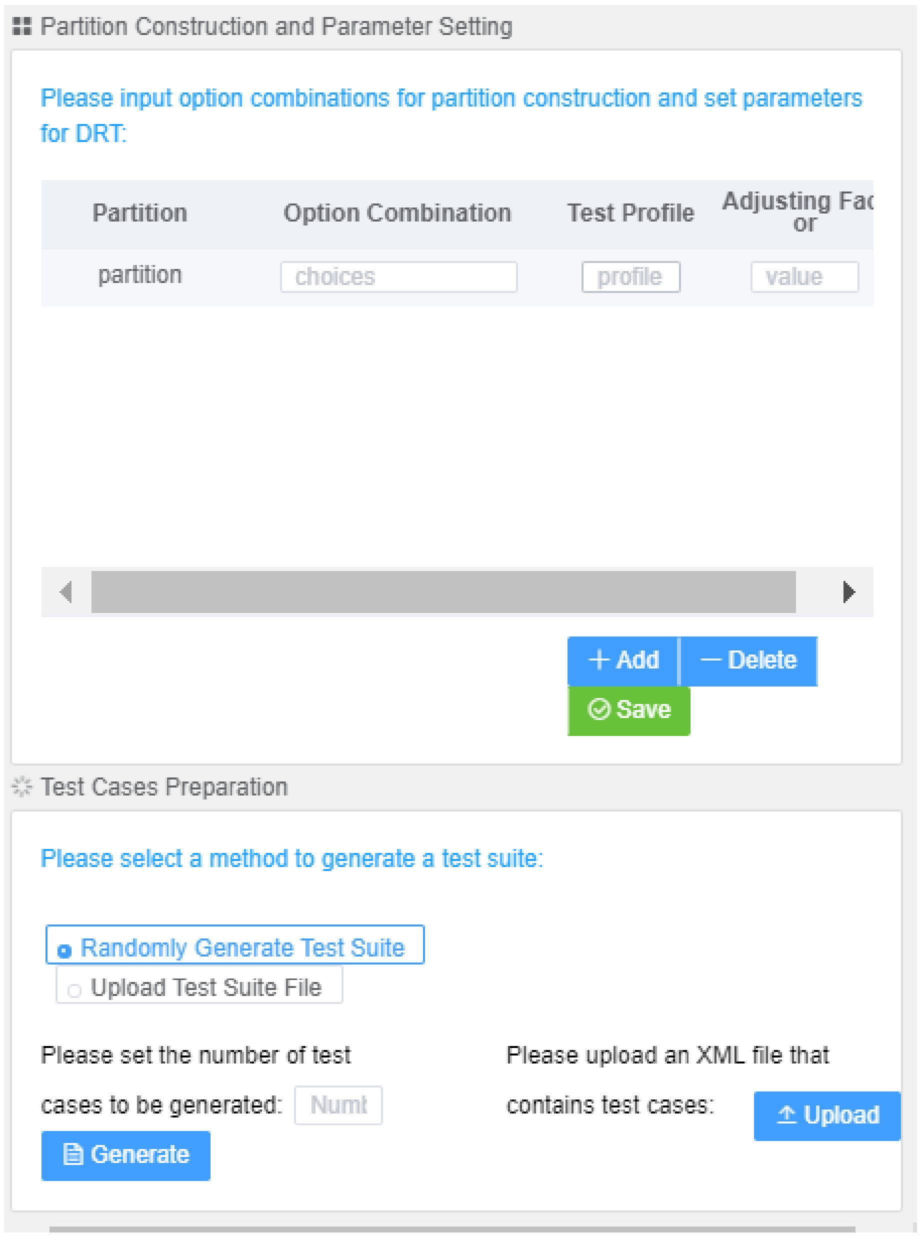
Parameters Setting

Please select an operator:

Operation

Index	Parameter	Type	Options
		Empty	

Save


Partition Construction and Parameter Setting

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

Partition	Option Combination	Test Profile	Adjusting Fac or
partition	choices	profile	value

Test Cases Preparation

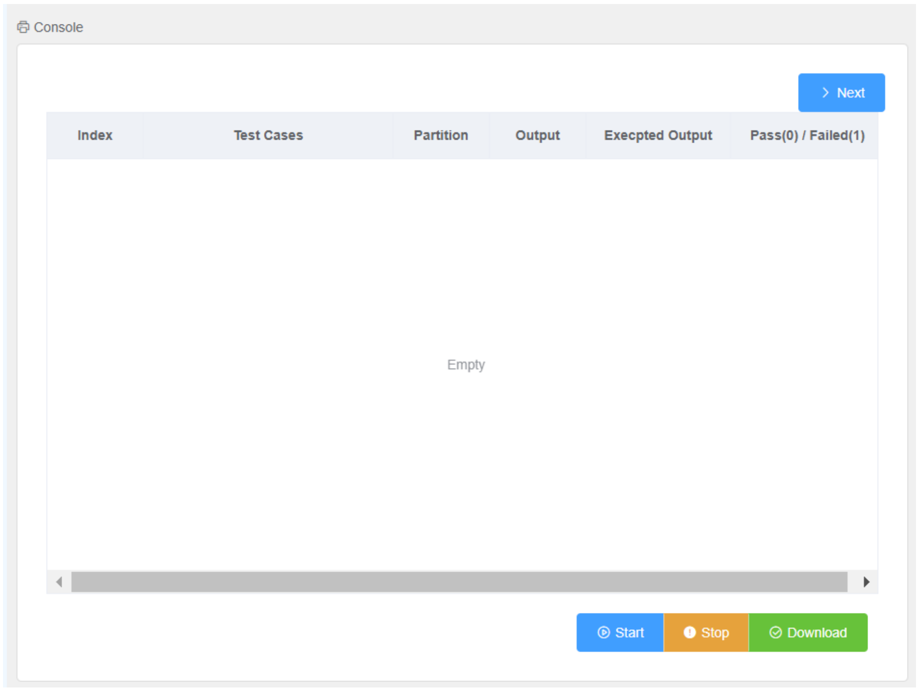
Please select a method to generate a test suite:

[✓ Randomly Generate Test Suite]
Upload Test Suite File

Please set the number of test cases to be generated: Numt

Please upload an XML file that contains test cases:

The third page of front-end interface is *Execution* (as shown in the following figures), *where the user controls the execution of test cases and downloads test report.*



Configuration for back-end logic

The user needs 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/)

the source codes of WSDL parsing service are available ~~by visiting the linkage:~~ https://github.com/phantomDai/parseesdlws.git.

The default port of this service is *8085*. If changing the port of this web service, the user needs to change the ~~the~~ value of variable *endpoint* in *ParseWSDL* script that is available ~~in linkage:~~ https://github.com/phantomDai/drtAPI.git. For instance, the user ~~replaces~~ the current value of *endpoint*

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

with

```
private static String endpoint =
"http://202.204.62.171:XXXX/services/parser?wsdl" (user's
port)
```

As for Restful micro-services, the user needs to set up the local environment as follows:

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

Then, the user executes the following command in the root directory of drtAPI file that is available ~~in linkage:~~ https://github.com/phantomDai/drtAPI.git.

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

Finally, the user goes to the "target" directory and executes the following command in DOS.

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

Congratulations! ~~you~~ have finished ~~the configurations of~~ environment.

An example

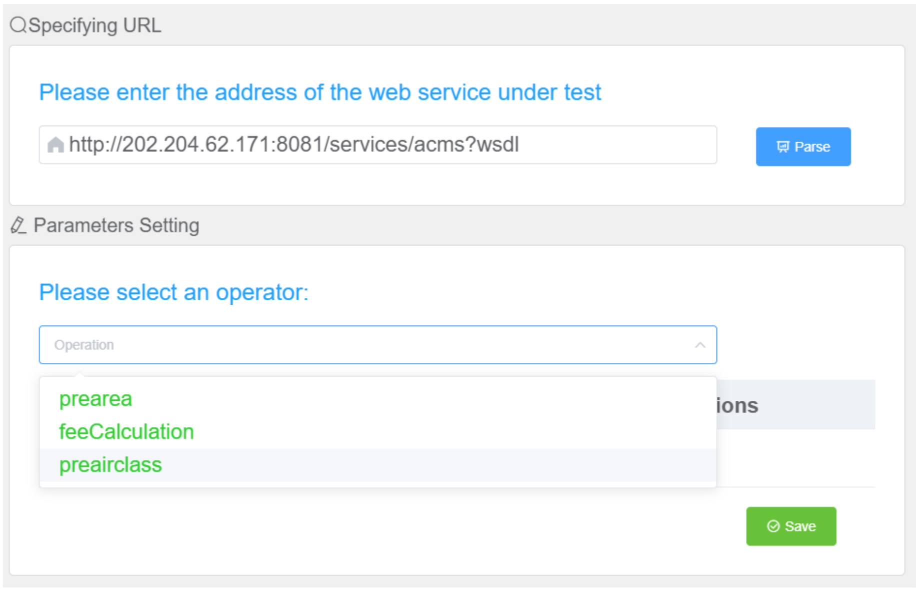
We use an example to demonstrate web service testing using our prototype tool.

~~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 cabin~~s~~ classes from which to choose (economy, business, and first), with passengers in different classes having different allowances.

Step 1: Specifying url and setting parameters

The user first enters the address of the WSDL of web service under test, ~~and~~ clicks the "Parse" button, and then selects the interested method of web service under test ~~in~~ the following drop-down menu (as shown in following figure).


Specifying URL

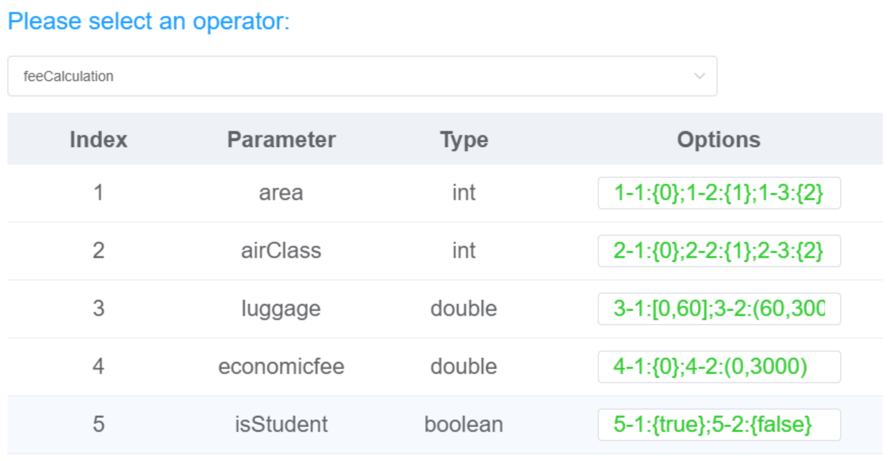
Please enter the address of the web service under test

http://202.204.62.171:8081/services/acms?wsdl

Parameters Setting

Please select an operator:

The user divides each parameter into disjoint options, and describes them according to predefined rules that are introduced in *Guidance* page (as shown in the following figure). Once the "Save" button is clicked, parameters and corresponding options are sent to some Restful micro-service.

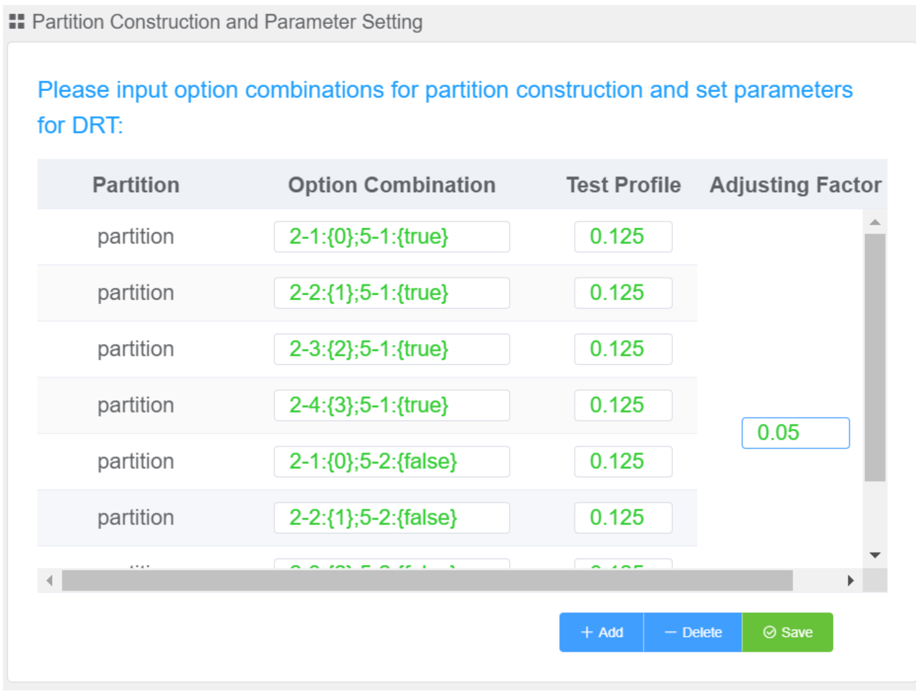

Please select an operator:

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

The user divides input domain by combining options with different parameters ~~of~~ selected method (as shown in following figure). Besides, the user needs to set the ~~selecting~~ probability for each partition, and the value of probability adjusting factor. After clicking the "Save" button, all provided information will be sent to some Restful micro-service, which is responsible for initializing test profile and setting the value of *epsilon*.

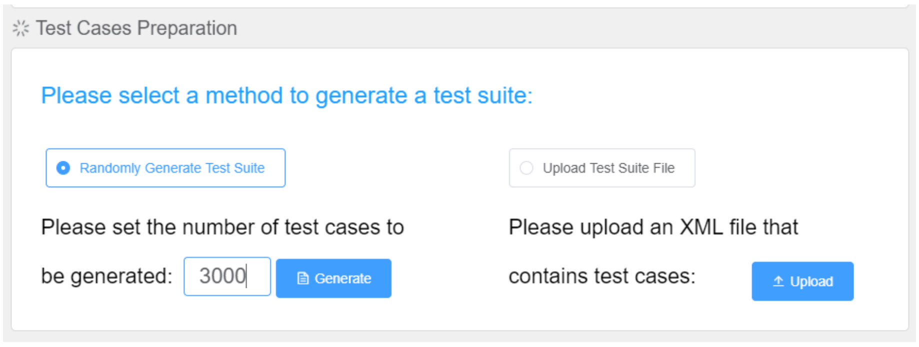

Partition Construction and Parameter Setting

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	0.05
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	
partition	2-1:{0};5-2:{false}	0.125	
partition	2-2:{1};5-2:{false}	0.125	

Step 3: Test case preparation

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


Test Cases Preparation

Please select a method to generate a test suite:

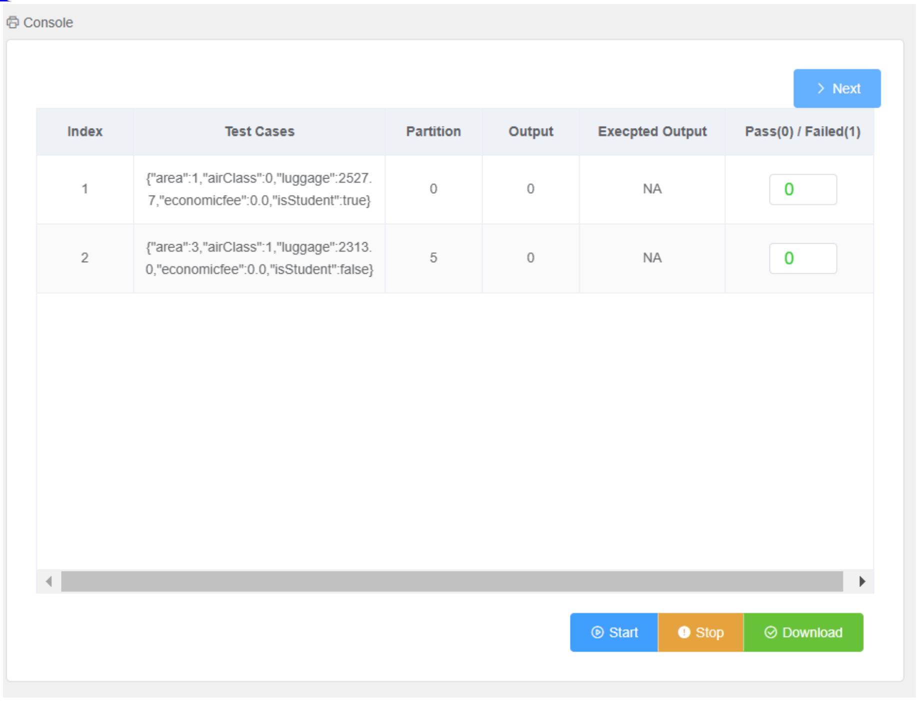
[✓ Randomly Generate Test Suite] Upload Test Suite File

Please set the number of test cases to be generated: 3000

Please upload an XML file that contains test cases:

Step 4: Test case execution

After performing all the steps above, all necessary ~~stuff~~ for testing are ~~ready~~. The user ~~first~~ clicks the *Start* button, then the table in the middle of page shows the information ~~of~~ testing. If test cases are generated ~~using random strategy~~, ~~the~~ user needs to decide whether the last test case detected a fault. If the test case detected a fault, the user ~~change~~ the value of the last row and last column in the table to "1". Then, next test case is executed by clicking the "Next" button. The "Stop" button is responsible for sending a signal to back-end logic, which means testing task is finished. The function of downloading test report is also supported by clicking the "Download" button.



Index	Test Cases	Partition	Output	Execpted Output	Pass(0) / Failed(1)
1	{"area":1,"airClass":0,"luggage":2527.7,"economicfee":0.0,"isStudent":true}	0	0	NA	0
2	{"area":3,"airClass":1,"luggage":2313.0,"economicfee":0.0,"isStudent":false}	5	0	NA	0