CLAIMS

What is claimed is:

1. A method for generating a smart contract test case, comprising:

determining a previous test case input to a to-be-tested smart contract as a first test case;

determining whether a new program path is covered when the to-be-tested smart contract executes the first test case;

in response to determining that a new program path is covered when the to-be-tested smart contract executes the first test case, determining the first test case as a current test case;

in response to determining that a new program path is not covered when the to-be-tested smart contract executes the first test case, determining a second test case as the current test case, wherein the second test case satisfies the following: the second test case has been input to the to-be-tested smart contract, and the first test case is obtained by mutating a structured parameter in the second test case;

selecting, for the current test case, at least one to-be-mutated structured parameter from structured parameters comprised in the current test case, wherein the to-be-mutated structured parameter can be identified by at least one interface of the to-be-tested smart contract;

for each to-be-mutated structured parameter, obtaining a parameter structure corresponding to the to-be-mutated structured parameter, wherein the parameter structure is determined by analyzing a pre-constructed sample structured parameter, and the sample structured parameter can be identified by at least one interface of the to-be-tested smart contract;

for each to-be-mutated structured parameter, mutating the to-be-mutated structured parameter based on the parameter structure corresponding to the to-be-mutated structured parameter, to obtain a mutated structured parameter, wherein the mutated structured parameter can be identified by at least one interface of the to-be-tested smart contract; and

generating a test case comprising each mutated structured parameter, and using the test case as a test case input to the to-be-tested smart contract.

2. The method according to claim 1, wherein each structured parameter comprises at least one piece of raw type data, and the parameter structure comprises a data type of raw type data; and

the mutating the to-be-mutated structured parameter based on the parameter structure corresponding to the to-be-mutated structured parameter comprises:

selecting at least one piece of to-be-mutated raw type data from all pieces of raw type data comprised in the to-be-mutated structured parameter;

determining a data type of each piece of to-be-mutated raw type data based on the parameter structure corresponding to the to-be-mutated structured parameter; and

performing parameter value mutation on the to-be-mutated raw type data based on the data type of each piece of to-be-mutated raw type data, to change a parameter value of the to-be-mutated structured parameter.

3. The method according to claim 2, wherein the performing parameter value mutation on the to-be-mutated raw type data based on the data type of each piece of to-be-mutated raw type data comprises:

if a data type of a to-be-mutated raw type data is a data type with an unlimited length, performing at least one of modifying a byte value, deleting a byte, inserting a byte, and shifting a byte on the to-be-mutated raw type data; or

if a data type of a to-be-mutated raw type data is a data type with a limited length, performing at least one of modifying a byte value and shifting a byte on the to-be-mutated raw type data.

4. The method according to claim 3, wherein

the data type with an unlimited length comprises a string type; and

the data type with a limited length comprises a 64-bit integer type or a 256-bit hash type.

5. The method according to any one of claims 1 to 4, wherein each structured parameter comprises at least one piece of raw type data, and the parameter structure comprises a start location or an end location of raw type data; and

the mutating the to-be-mutated structured parameter based on the parameter structure corresponding to the to-be-mutated structured parameter comprises:

determining a start location or an end location of each piece of raw type data in the to-be-mutated structured parameter based on the start location or the end location

of the raw type data comprised in the parameter structure; and

adding at least one piece of raw type data before a start location or after an end location of at least one piece of raw type data comprised in the to-be-mutated structured parameter, to change the parameter structure of the to-be-mutated structured parameter.

6. The method according to any one of claims 1 to 4, wherein each structured parameter comprises at least two pieces of raw type data, and the parameter structure comprises a start location or an end location of raw type data; and

the mutating the to-be-mutated structured parameter based on the parameter structure corresponding to the to-be-mutated structured parameter comprises:

determining a start location or an end location of each piece of raw type data in the to-be-mutated structured parameter based on the start location or the end location of the raw type data comprised in the parameter structure; and

deleting at least one piece of raw type data based on the start location or the end location of each piece of raw type data comprised in the to-be-mutated structured parameter, to change the parameter structure of the to-be-mutated structured parameter.

7. The method according to any one of claims 1 to 4, wherein each structured parameter comprises at least two pieces of raw type data, and the parameter structure comprises a sequence of all pieces of raw type data; and

the mutating the to-be-mutated structured parameter based on the parameter structure corresponding to the to-be-mutated structured parameter comprises:

determining a sequence of all pieces of raw type data in the to-be-mutated structured parameter based on the parameter structure corresponding to the to-be-mutated structured parameter; and

changing the sequence of all the pieces of raw type data in the to-be-mutated structured parameter, to change the parameter structure of the to-be-mutated structured parameter.

8. An apparatus for generating a smart contract test case, comprising:

a first case acquisition unit, configured to determine a previous test case input to a to-be-tested smart contract as a first test case, determine whether a new program path is covered when the to-be-tested smart contract executes the first test case, in response to determining that a new program path is covered when the to-be-tested smart contract

executes the first test case, determine the first test case as a current test case, and in response to determining that a new program path is not covered when the to-be-tested smart contract executes the first test case, determine a second test case as the current test case, wherein the second test case satisfies the following: the second test case has been input to the to-be-tested smart contract, and the first test case is obtained by mutating a structured parameter in the second test case;

a parameter selection unit, configured to select, for the current test case, at least one to-be-mutated structured parameter from structured parameters comprised in the current test case, wherein the to-be-mutated structured parameter can be identified by at least one interface of the to-be-tested smart contract;

a structure identification unit, configured to: for each to-be-mutated structured parameter selected by the parameter selection unit, obtain a parameter structure corresponding to the to-be-mutated structured parameter, wherein the parameter structure is determined by analyzing a pre-constructed sample structured parameter, and the sample structured parameter can be identified by at least one interface of the to-be-tested smart contract;

a parameter mutation unit, configured to: for each to-be-mutated structured parameter, mutate the to-be-mutated structured parameter based on the parameter structure corresponding to the to-be-mutated structured parameter that is obtained by the structure identification unit, to obtain a mutated structured parameter, wherein the mutated structured parameter can be identified by at least one interface of the to-be-tested smart contract; and

a case generation unit, configured to generate a test case comprising each mutated structured parameter obtained by the parameter mutation unit, and use the test case as a test case input to the to-be-tested smart contract.

9. The apparatus according to claim 8, wherein each structured parameter comprises at least one piece of raw type data, and the parameter structure comprises a data type of raw type data; and

the parameter mutation unit comprises:

a data selection subunit, configured to select at least one piece of to-be-mutated raw type data from all pieces of raw type data comprised in one to-be-mutated structured parameter;

a type identification subunit, configured to determine a data type of each piece of

to-be-mutated raw type data selected by the data selection subunit based on the parameter structure corresponding to the to-be-mutated structured parameter; and

a first mutation subunit, configured to perform parameter value mutation on the to-be-mutated raw type data based on the data type of each piece of to-be-mutated raw type data that is determined by the type identification subunit, to change a parameter value of a to-be-mutated structured parameter comprising the to-be-mutated raw data type.

10. The apparatus according to claim 9, wherein

the first mutation subunit is configured to: for each piece of to-be-mutated raw type data, if a data type of the to-be-mutated raw type data is a data type with an unlimited length, perform at least one of modifying a byte value, deleting a byte, inserting a byte, and shifting a byte on the to-be-mutated raw type data; or if a data type of the to-be-mutated raw type data is a data type with a limited length, perform at least one of modifying a byte value and shifting a byte on the to-be-mutated raw type data.

11. The apparatus according to claim 10, wherein

the data type with an unlimited length comprises a string type; and

the data type with a limited length comprises a 64-bit integer type or a 256-bit hash type.

12. The apparatus according to any one of claims 8 to 11, wherein each structured parameter comprises at least one piece of raw type data, and the parameter structure comprises a start location or an end location of raw type data; and

the parameter mutation unit comprises:

a first location identification subunit, configured to determine a start location or an end location of each piece of raw type data in the to-be-mutated structured parameter based on a start location or an end location of at least one piece of raw type data comprised in the parameter structure; and

a data adding subunit, configured to: for one to-be-mutated structured parameter, add at least one piece of raw type data before a start location or after an end location of at least one piece of raw type data comprised in the to-be-mutated structured parameter based on the start location or the end location of each piece of raw type data in the to-be-mutated structured parameter that is determined by the first location identification subunit, to change the parameter structure of the to-be-mutated structured parameter.

13. The apparatus according to any one of claims 8 to 11, wherein each structured

parameter comprises at least two pieces of raw type data, and the parameter structure comprises a start location or an end location of raw type data; and

the parameter mutation unit comprises:

a second location identification subunit, configured to determine a start location or an end location of each piece of raw type data in the to-be-mutated structured parameter based on the start location or the end location of the raw type data comprised in the parameter structure; and

a data deletion subunit, configured to: for one to-be-mutated structured parameter, delete at least one piece of raw type data in the to-be-mutated structured parameter based on the start location or the end location of each piece of raw type data in the to-be-mutated structured parameter that is determined by the second location identification subunit, to change the parameter structure of the to-be-mutated structured parameter.

14. The apparatus according to any one of claims 8 to 11, wherein each structured parameter comprises at least two pieces of raw type data, and the parameter structure comprises a sequence of all pieces of raw type data; and

the parameter mutation unit comprises:

a sequence identification subunit, configured to determine a sequence of all pieces of raw type data in one to-be-mutated structured parameter based on the parameter structure corresponding to the to-be-mutated structured parameter; and

a data sequence adjustment subunit, configured to: for one to-be-mutated structured parameter, change a sequence of all pieces of raw type data in the to-be-mutated structured parameter based on a sequence of all the pieces of raw type data in the to-be-mutated structured parameter that is determined by the sequence identification subunit, to change a parameter structure of the to-be-mutated structured parameter.

15. A computer-readable storage medium, wherein the computer-readable storage medium stores computer programs, and when being executed in a computer, the computer program enables the computer to perform the method according to any one of claims 1 to 7.

16. A computing device, comprising a memory and a processor, wherein the memory stores executable code, and the processor implements the method according to any one of claims 1 to 7 when executing the executable code.