Heavy-Duty Program Analysis with DIVINE

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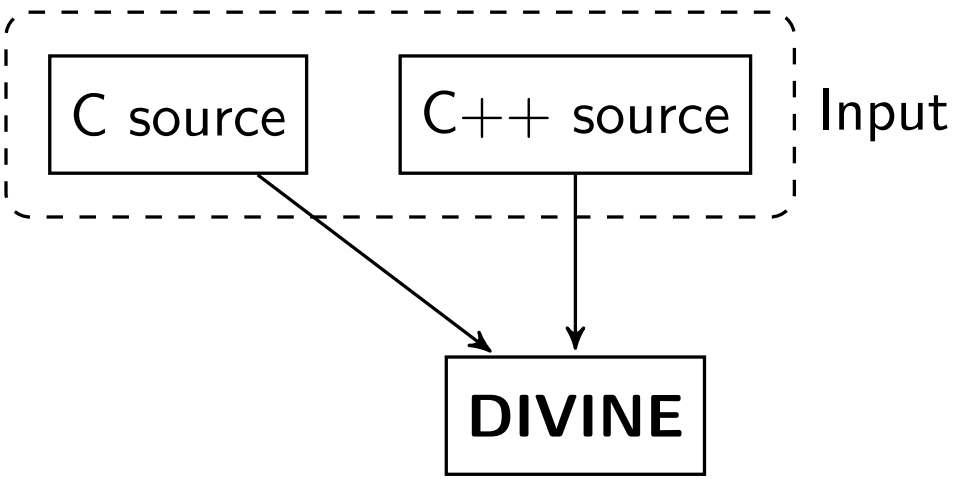
What is DIVINE?



DIVINE can find hard to discover problems in C and C++ programs.

```
$ divine check program.cpp
```

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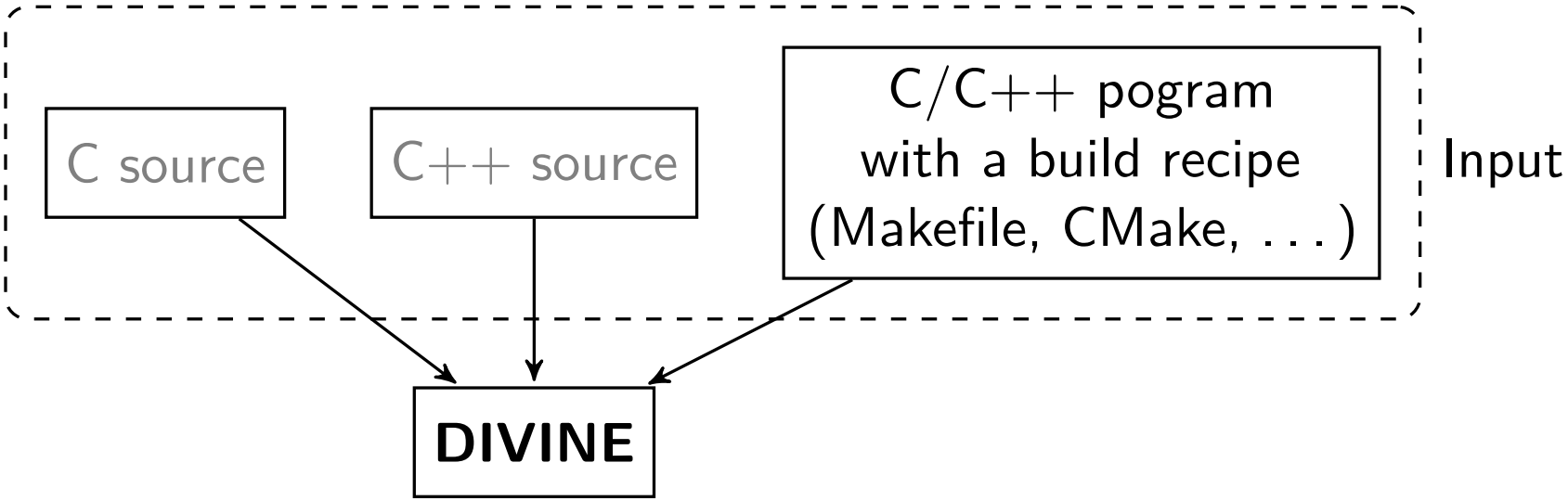

It can process single files, or we can use a replacement compiler to compile larger programs so they can be processed by DIVINE.

```
$ make CC=divcc
$ divine check build/program
```

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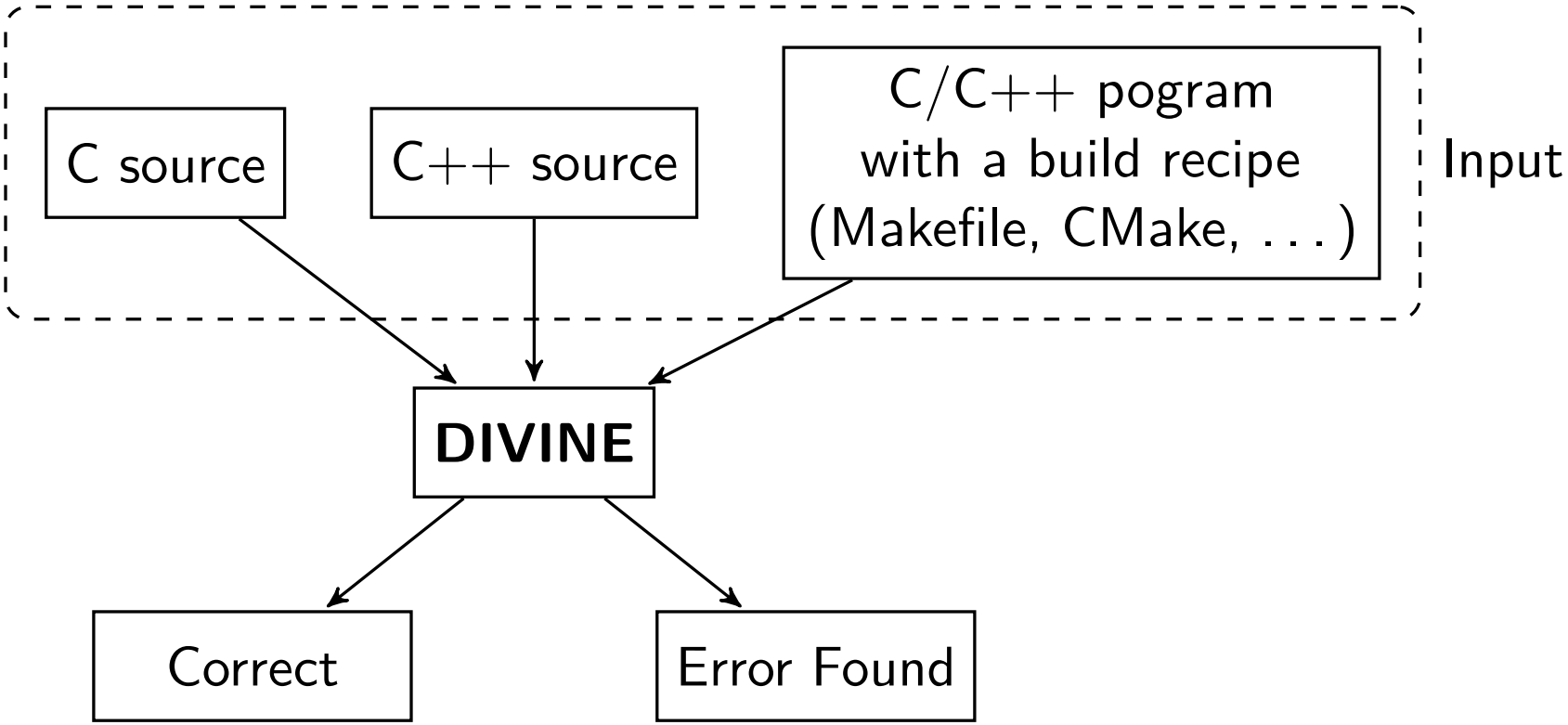

Given enough resources, DIVINE will produce result.
If an error is found, DIVINE will produce a report.

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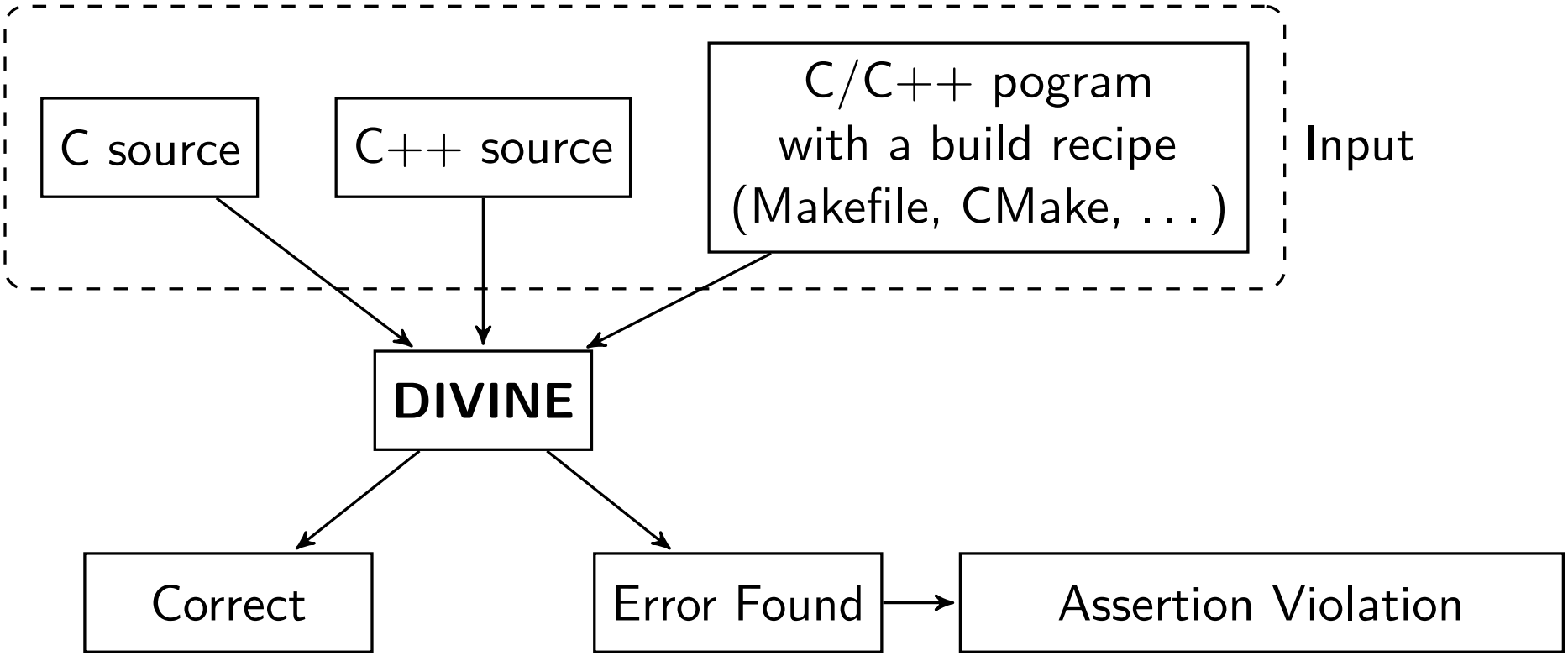


```
int foo( int x ) { assert( x > 0 ); /* ...  */ }
int main() {
    int x = input();
    if ( x >= 0 ) { foo( x ); }
}
```

there can be *input* variables with arbitrary/unspecified values

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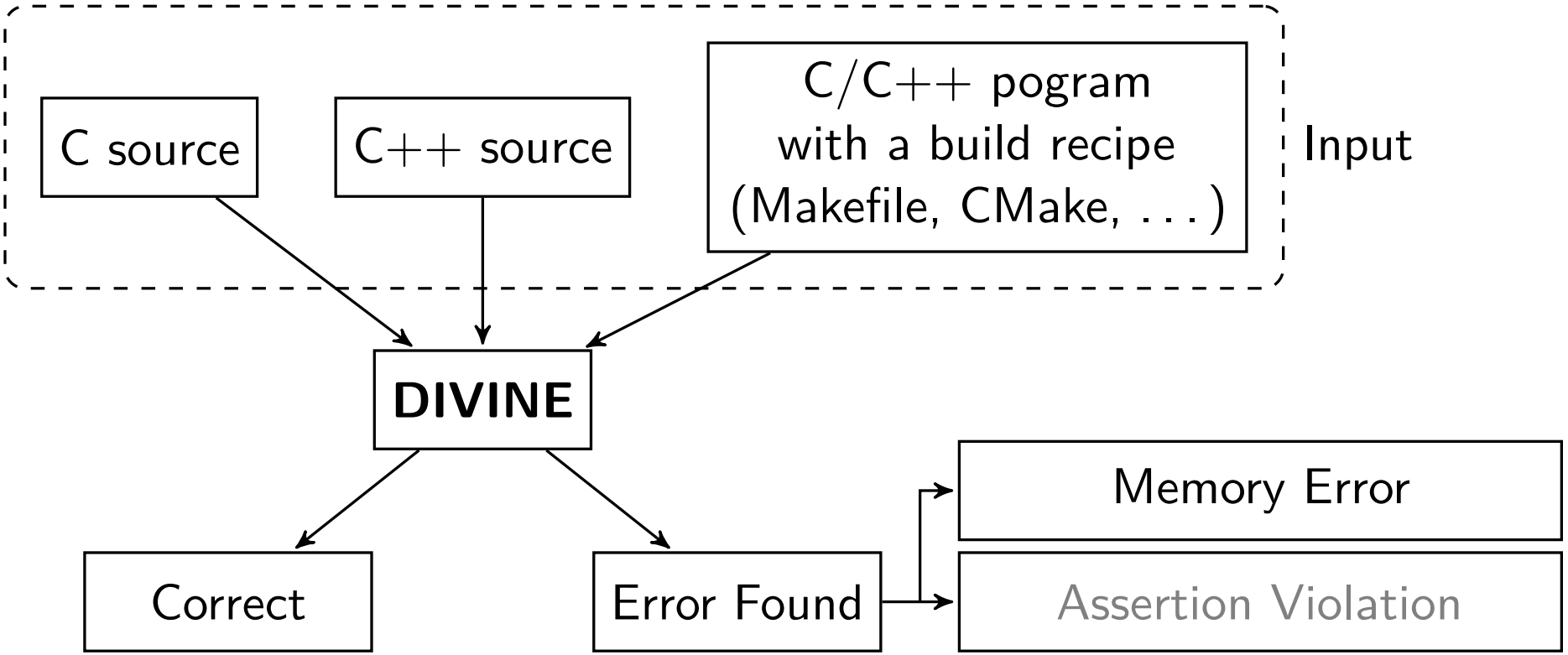


```
int main() {
    int x = 100;
    int array[100];
    array[x] = 42;
}
```

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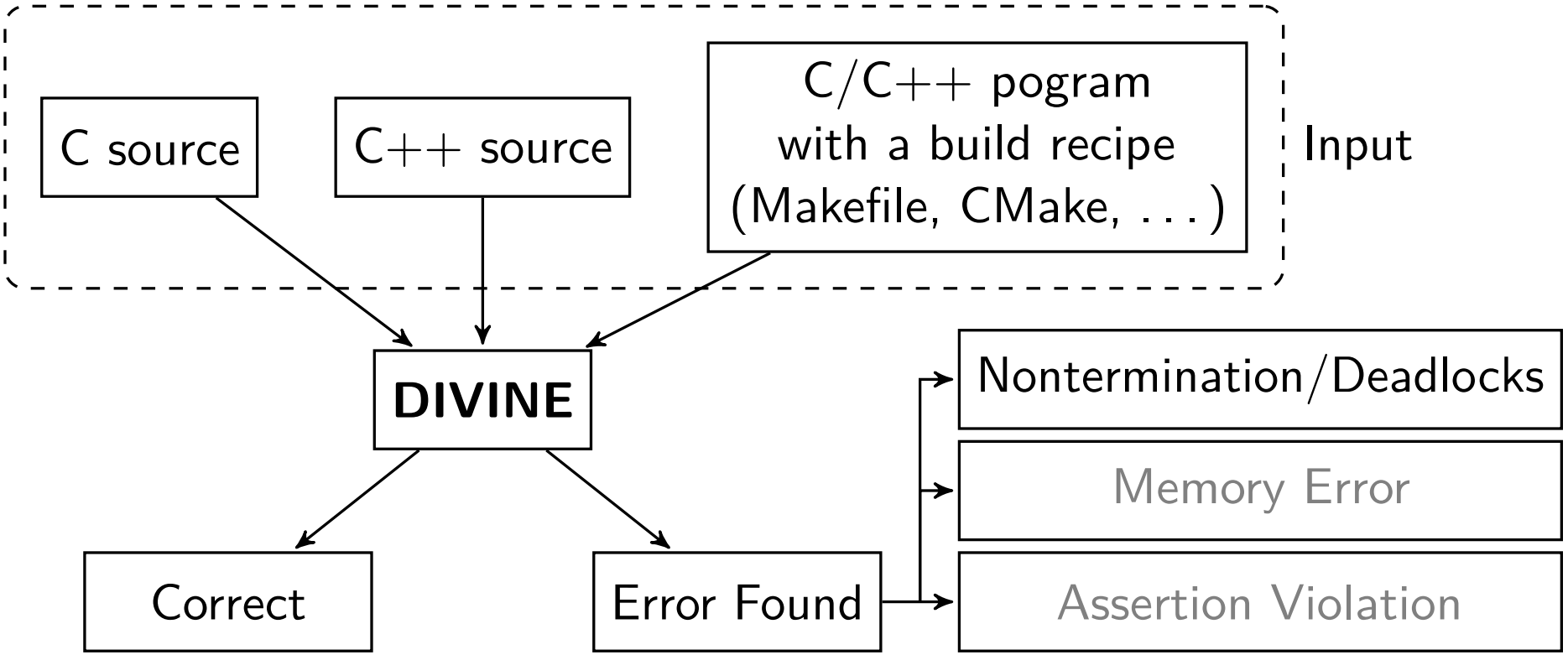


```
void thread1() {
    while ( x != 0 ) { /* wait */ }
    /* ...  */
}
void thread2() { x = 42; }
```

DIVINE explores all possible runs

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   - no assembly components or inline assembly

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  - DIVINE explores all possible ways the threads can interleave

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- verification can be resource intensive
  - due to parallelism
  - due to inputs/unspecified values
  - due to memory tracking
- if an error is found, it can be analysed using an interactive simulator
  - a debugger-like tool integrated in DIVINE

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  1. run the program in a way it can communicate and capture the communication
  2. use the capture in verification
     - only works if the program does not encounter need for further communication during verification run
- capture + replay can also make debugging these programs easier

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Abstractions

- we are working on different ways to abstract data
- including lossy/imprecise abstractions which are faster and can still provide some guarantees