

Breaking Software

Software tends not to break much on the happy path. Malicious users, Systems going down, When you're off in the wilderness.

Off-By-One Errors
A common off-by-one error occurs when you specify a range of values incorrectly.
Example:
`for (int i = 0; i < 10; i++) {
 // ...
}`
This code will only iterate 9 times, not 10.

Logic Errors
The logic of the program is incorrect.
Example:
`if (age < 35) {
 System.out.println("You can president!");
} else {
 System.out.println("Wait a few years...");
}`

Boundary / Off-By-One Errors
Handling a boundary point gives unexpected results.
Example:
`int count = 0;
while (count < 10) {
 // ...
 count++;
}`
This code will only iterate 9 times, not 10.

Concurrency Errors
Errors that occur when multiple threads execute simultaneously.
Example:
`int count = 0;
Thread t1 = new Thread() {
 public void run() {
 count++;
 }
};
Thread t2 = new Thread() {
 public void run() {
 count++;
 }
};
t1.start();
t2.start();
t1.join();
t2.join();
System.out.println(count);`

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Off-By-One Errors

A subset of logic errors where values are specified incorrectly by one unit.

```
if (age > 70) {  
    System.out.println("You can president!");  
} else {  
    System.out.println("Wait a few years...");  
}
```

Logic Errors

The logic of the program is incorrect.

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if (age < 35) {  
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} else {  
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```

Rounding / Floating Point Errors

Rounding or floating point gave incorrect results.

```
double result = 1.0 / 3.0 * 3.0;  
double total = result * 100.0;  
System.out.println("Total: " + total);  
// Expected: 100.0, Actual: 99.99999999999999
```

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Rounding / Floating Point Errors

Rounding or floating point give incorrect results.

```
double oneVal = 1.0 / 857.0;  
double total = oneVal * 857.0;  
System.out.println("Should be 1.0, actually = " + total);  
boolean areEqual = (total == 1.0);  
System.out.println("Are equal? " + areEqual);
```

Integration Errors

Errors at boundaries between systems/subsystems.

```
int startDistanceInKilometers = 14;  
spacecraft.setDistance(startDistanceInKilometers);  
...  
public class Spacecraft  
public void setDistance(int distanceInMiles) {  
    ...  
}
```

Errors of Assumption

The developer or system makes an assumption which turns out to be incorrect or at odds with other assumptions.

```
OutputFile.write(TAB_DELIMITED);
```

```
....
```

```
InputFile.read(COMMA_DELIMITED);
```


Missing Data Errors

An error occurs because needed data is missing and the system cannot operate properly without it.

```
public static void main(String[] args) {  
    System.out.println(args[3]);  
}
```

Bad Data Errors

System cannot handle improperly formatted or invalid data.

Enter two numbers to divide: 7 0

Exception in thread "main"

java.lang.ArithmeticException: / by zero

Display Errors

The data is correct but not displayed properly.

```
double pi = Math.PI;  
System.out.printf("Pi is equal to exactly... %.1f!", pi);
```

Null Pointer Error

The program dereferences a null pointer.

```
String oneILove = null;  
oneILove = oneILove.toUpperCase();  
System.out.printf(  
    "This one goes out to the one I love," + oneILove);
```

Network / File / I/O Error

The system encounters an unexpected state of disk, network, or other I/O and cannot handle it.

```
try {  
    // read in file  
} catch (FileNotFoundException e) {  
    // AAAGH WHAT DO I DO  
    System.exit(1);  
}
```

Configuration Errors

The system could work correctly, but it was not configured to work correctly.

'javac' is not recognized as an internal or external command, operable program or batch file.

The list goes on...

Accessibility errors...

Domain-specific errors...

Version mismatch errors...

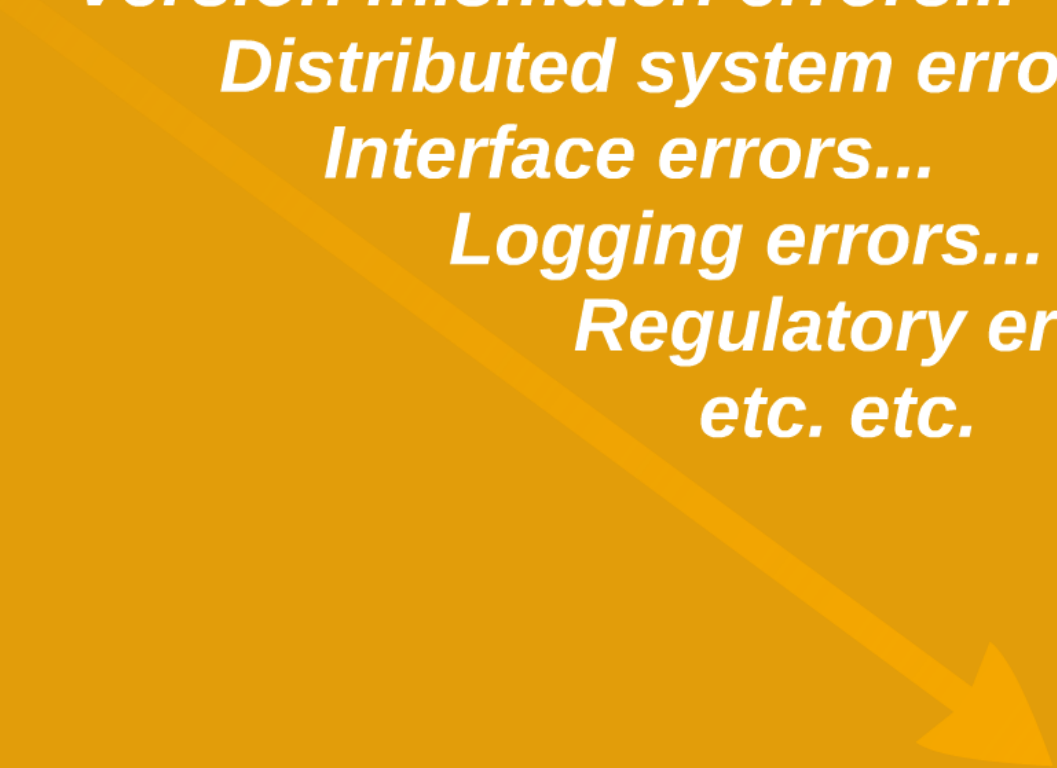
Distributed system errors...

Interface errors...

Logging errors...

Regulatory errors...

etc. etc.



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Rounding / Floating Point Errors

Rounding or floating point gave incorrect results.

```
double result = 1.0 / 3.0 * 3.0;  
double result = 0.9999999999999999;  
System.out.println("result is: " + result);  
// result is: 0.9999999999999999  
// System.out.println("result is: " + result);  
// result is: 1.0
```