

02

OPEN ORIENTED

凹凸实验室

Tail Call Optimization

Secbone

The story begins with an error ...

Maximum call stack size exceeded

```
1  function b(x) {  
2      return x  
3  }  
4  
5  function a(n) {  
6      let q = n + n  
7      return b(q)  
8  }  
9  
10 a(1)  
11
```


```
1  function b(x) {  
2      return x  
3  }  
4  
5  function a(n) {  
6      let q = n + n  
7      return b(q)  
8  }  
9  
10 a(1)  
11
```



Global stack

```
b = function(x) { ... }  
a = function(n) { ... }
```

```
1  function b(x) {  
2      return x  
3  }  
4  
5  function a(n) {  
6      let q = n + n  
7      return b(q)  
8  }  
9  
10 a(1)  
11
```




stack of a()

Global stack

n = 1
q = 2
return b(2)

b = function(x) { ... }
a = function(n) { ... }

```
1  function b(x) {  
2      return x  
3  }  
4  
5  function a(n) {  
6      let q = n + n  
7      return b(q)  
8  }  
9  
10 a(1)  
11
```



stack of b()

stack of a()


Global stack

x = 2
return 2

n = 1
q = 2
return b(2)

b = function(x) { ... }
a = function(n) { ... }

```
1  function b(x) {  
2      return x  
3  }  
4  
5  function a(n) {  
6      let q = n + n  
7      return b(q)  
8  }  
9  
10 a(1)  
11
```



stack of a()

Global stack

n = 1
q = 2
return b(2)

b = function(x) { ... }
a = function(n) { ... }


```
1  function b(x) {  
2      return x  
3  }  
4  
5  function a(n) {  
6      let q = n + n  
7      return b(q)  
8  }  
9  
10 a(1)  
11
```



Global stack

```
b = function(x) { ... }  
a = function(n) { ... }
```

```
1  function b(x) {  
2      return x  
3  }  
4  
5  function a(n) {  
6      let q = n + n  
7      return b(q)  
8  }  
9  
10 a(1)  
11
```

we get 2

Recursion

```
1  function fib(n) {  
2      if(n < 3) return 1  
3  
4      return fib(n - 1) + fib(n - 2)  
5  }  
6  
7  fib(10)  
8
```

```
1  function fib(n) {  
2      if(n < 3) return 1  
3  
4      return fib(n - 1) + fib(n - 2)  
5  }  
6  
7  fib(10)  
8
```

n = 1
return 1

.....

n = 10
return fib(9) + fib(8)

fib = function(n) { ... }

```
1  function fib(n) {  
2      if(n < 3) return 1  
3  
4      return fib(n - 1) + fib(n - 2)  
5  }  
6  
7  fib(10000000)  
8
```

n = ?
return ???

.....

n = 10000000
return fib(9999999) + fib(9999998)

fib = function(n) { ... }

Maximum call stack size exceeded

What is the size of the stack?


```
1  var i = 0
2
3  function t() {
4      i++
5      t()
6  }
7
8  t()
9
```

Chrome 60

10444

Safari 10

36241

<http://adamrich.name/recursion.html>

Tail Recursion

```
1  function fib(n, a = 0, b = 1) {  
2      if(n == 0) return a  
3      if(n == 1) return b  
4  
5      return fib(n - 1, b, a + b)  
6  }  
7  
8  fib(10)
```

```
1  function fib(n, a = 0, b = 1) {  
2      if(n == 0) return a  
3      if(n == 1) return b  
4  
5      return fib(n - 1, b, a + b)  
6  }  
7  
8  fib(10)
```

fib(10)

n = 10
a = 0
b = 1
return fib(9, 1, 1)

fib = function(n, a = 0, b = 1) { ... }

```
1  function fib(n, a = 0, b = 1) {  
2      if(n == 0) return a  
3      if(n == 1) return b  
4  
5      return fib(n - 1, b, a + b)  
6  }  
7  
8  fib(10)
```

fib(9)

```
n = 9  
a = 1  
b = 1  
return fib(8, 1, 2)
```

```
fib = function(n, a = 0, b = 1) { ... }
```


```
1  function fib(n, a = 0, b = 1) {  
2      if(n == 0) return a  
3      if(n == 1) return b  
4  
5      return fib(n - 1, b, a + b)  
6  }  
7  
8  fib(10)
```

fib(1)

n = 1
a = 34
b = 55
return 55

fib = function(n, a = 0, b = 1) { ... }


```
1  function fib(n, a = 0, b = 1) {  
2      if(n == 0) return a  
3      if(n == 1) return b  
4  
5      return fib(n - 1, b, a + b)  
6  }  
7  
8  fib(10)
```



we get 55

```
fib = function(n, a = 0, b = 1) { ... }
```

Tail Call Optimization (TCO)

Proper Tail Calls (PTC)



Safari 10

node 6

--harmony_tailcalls

strict mode

Examples

Why not shipping?

Q&A

T H A N K S
FOR YOUR WATCHING