ASYNCHRONICITY

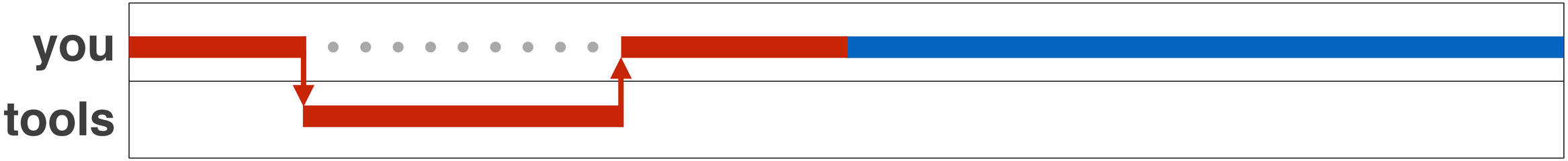
CONCURRENCY

"Let's bake a cake"

1. You only make the icing after the cake comes out of the oven
2. You make the icing while the cake is in the oven
3. I only make the icing and you only make the cake

CONCURRENCY

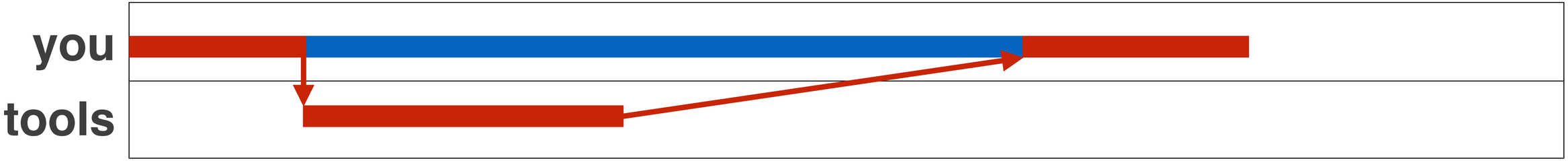
Blocking…



1. You only make the icing after the cake comes out of the oven

CONCURRENCY

Non-blocking…



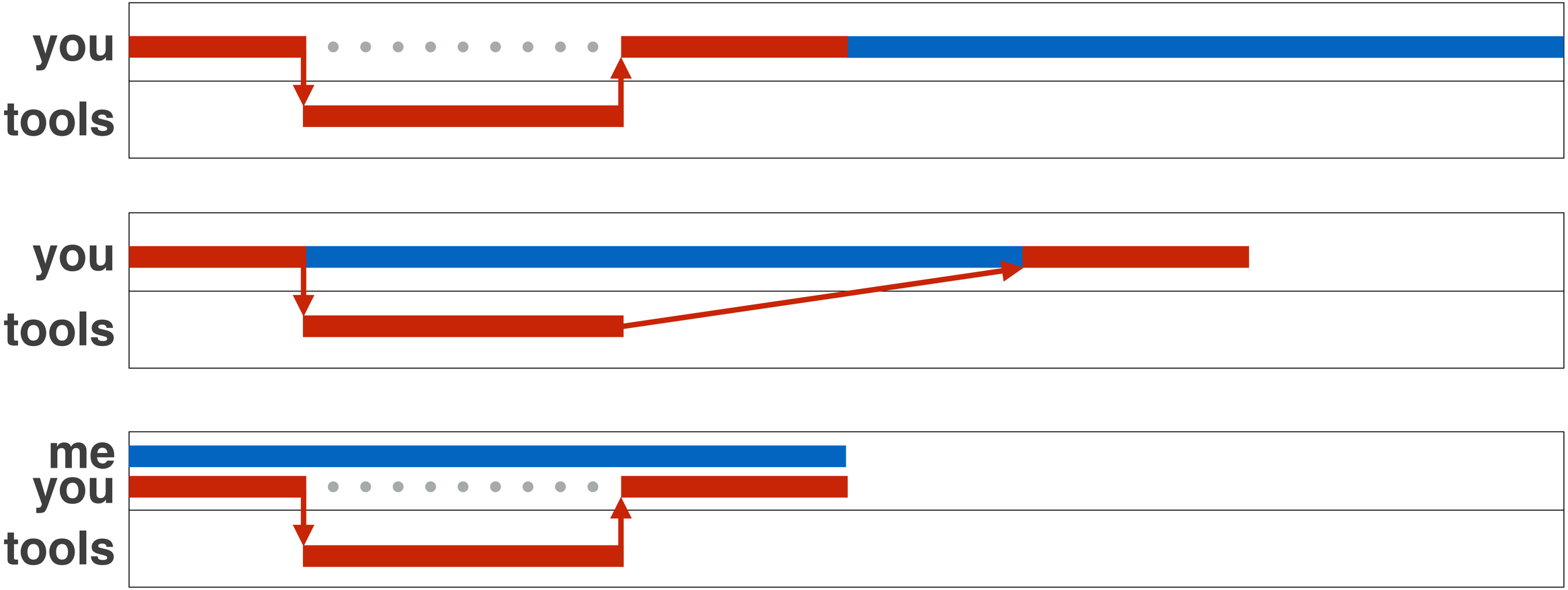
2. You make the icing while the cake is in the oven

CONCURRENCY

Parallel…

3. I only make the icing and you only make the cake

WHICH DESCRIBES JAVASCRIPT?



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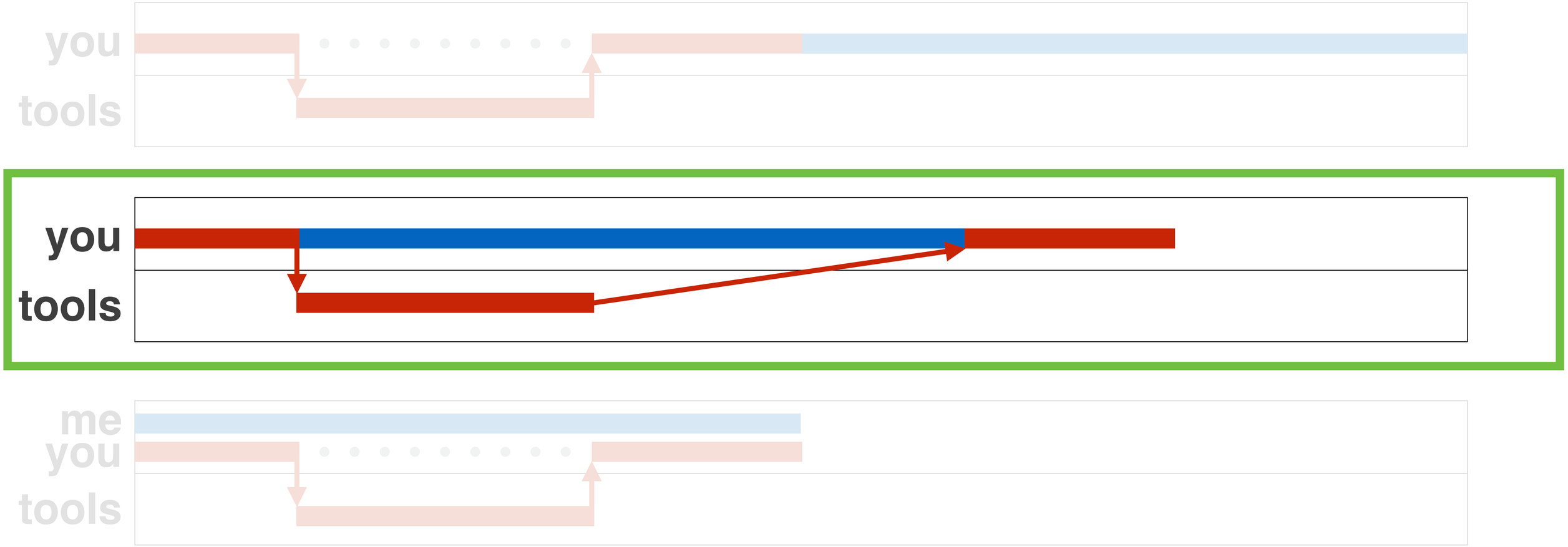

"Node.js is a single-threaded, event-driven, non-blocking I/O platform"

– SOME PEOPLE ON THE INTERNET

Er, not exactly

"Node.js is a ~~single-threaded~~, event-driven, non-blocking I/O platform"

– SOME PEOPLE ON THE INTERNET

"JavaScript is single-threaded"

– OTHER PEOPLE ON THE INTERNET

"JavaScript is single-threaded" …arguably yes

– OTHER PEOPLE ON THE INTERNET

ASYNC

ASYNC

(Code is asynchronous if) the execution order is not dependent upon the command order

WHAT HAPPENS?

```
console.log(‘Some callbacks');
setTimeout(function(){
  console.log('you');
}, 3000);
console.log('love');
```

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you
```

EVENT BASED

A function that executes asynchronously…

1. Kicks off some external process
2. Registers an event handler for when that process finishes (callback)

WHAT HAPPENS?

```
var start = new Date;
setTimeout(function(){
  var end = new Date;
  console.log('Time elapsed:', end - start, 'ms');
}, 500);

while (new Date - start < 1000) {};
```

WHAT HAPPENS?

```
var start = new Date;
setTimeout(function(){
  var end = new Date;
  console.log('Time elapsed:', end - start, 'ms');
}, 500);

while (new Date - start < 1000) {};
```

```
=> Time elapsed: 1000 ms
```

WHY?

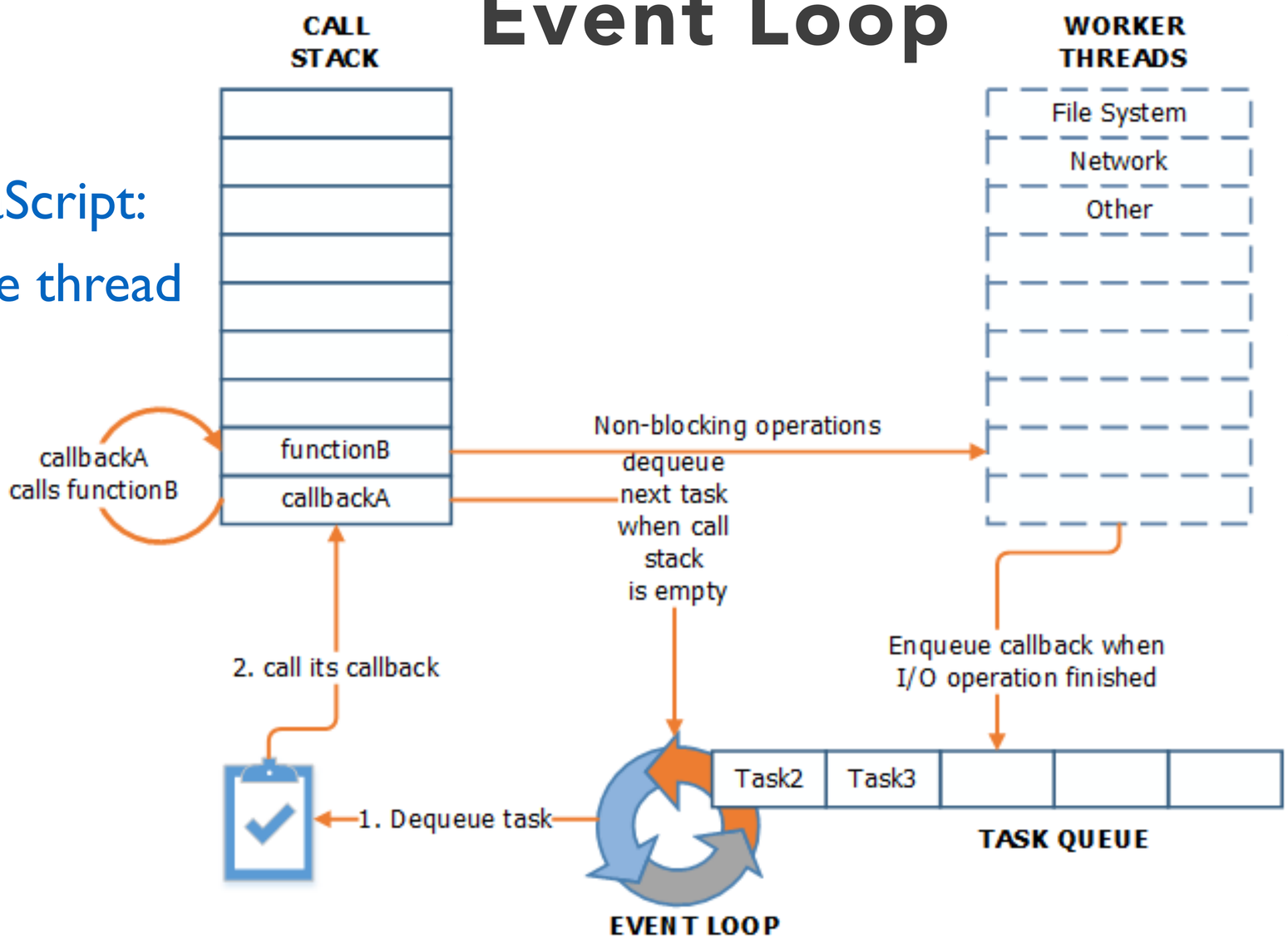
```
var start = new Date;
setTimeout(function(){ // starts up a timeout only
  var end = new Date;
  console.log('Time elapsed:', end - start, 'ms');
}, 500);

while (new Date - start < 1000) {}; // idles for 1000 ms
// meanwhile, halfway through, the timer finishes
// but while loops are blocking
// and js does not interrupt blocking commands
// after the while it has no other commands
// so it will execute the queued callback
```

Event Loop

JavaScript:

One thread



Thread pool (libeio):

Slow stuff, multiple threads

Event loop (libev):

One thread

How do I know if a function is asynchronous?

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If you want to be sure, you have to look it up

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That doesn’t help

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…Wait really?

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If you want to be sure, you have to look it up

That doesn't help

…Wait really?

Well, async operations often have the following callback pattern:

```
asyncThing(function(err,data){…})
```

SUMMARY

- JavaScript is single-threaded but its runtime environment is not
- A callback executes when its async event finishes
- Anything you wish to do *after* the async event completes *must* happen in the callback