ASYNCHRONICITY

Do a skit

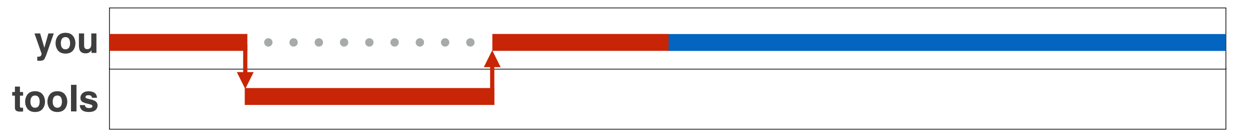
CONCURRENCY

"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

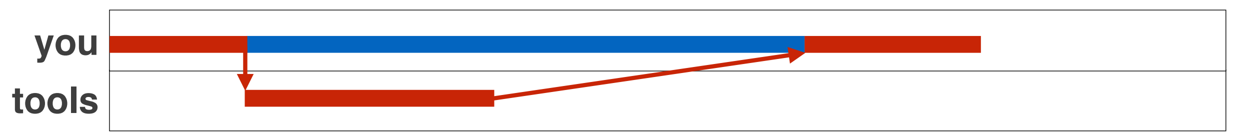
Blocking…



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

CONCURRENCY

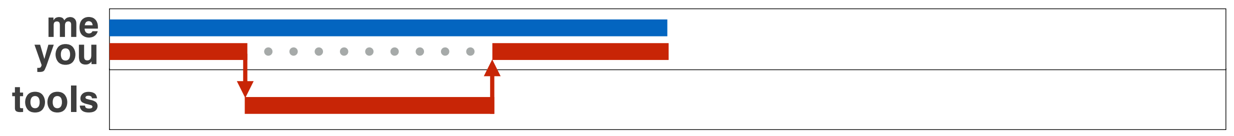
Non-blocking…



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

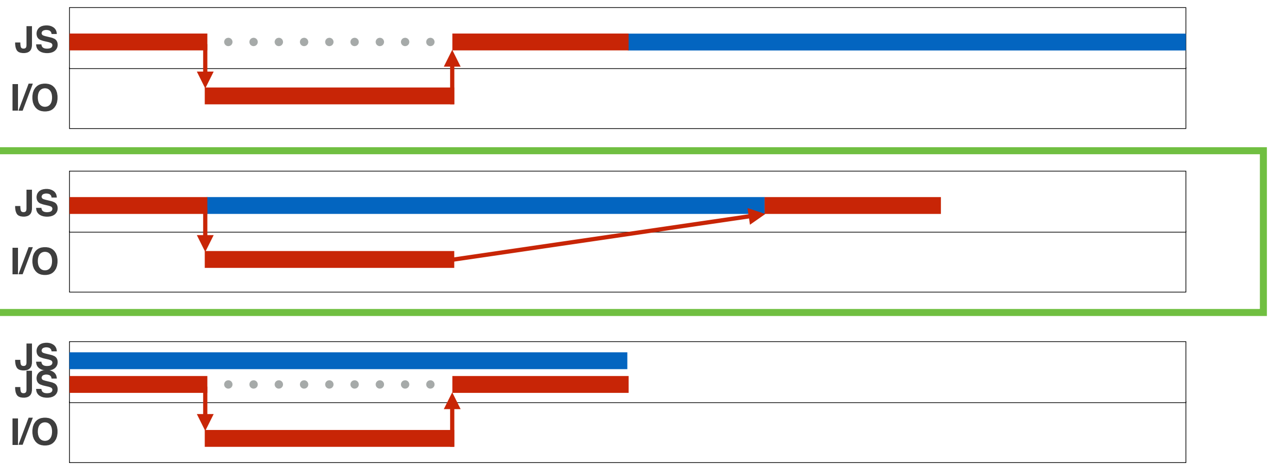
CONCURRENCY

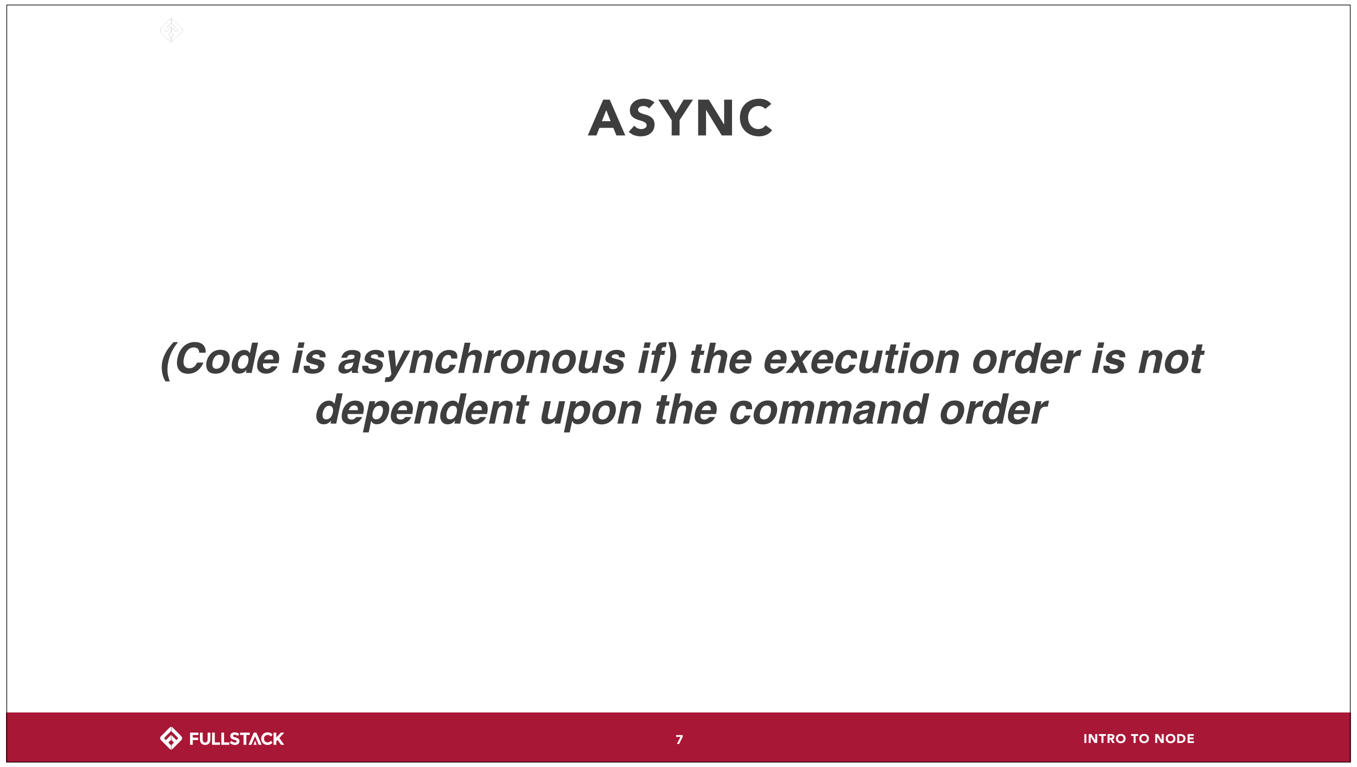
Parallel…



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

WHICH DESCRIBES JAVASCRIPT?





ASYNC

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

Q: What does it mean for code to be asynchronous?

WHAT HAPPENS?

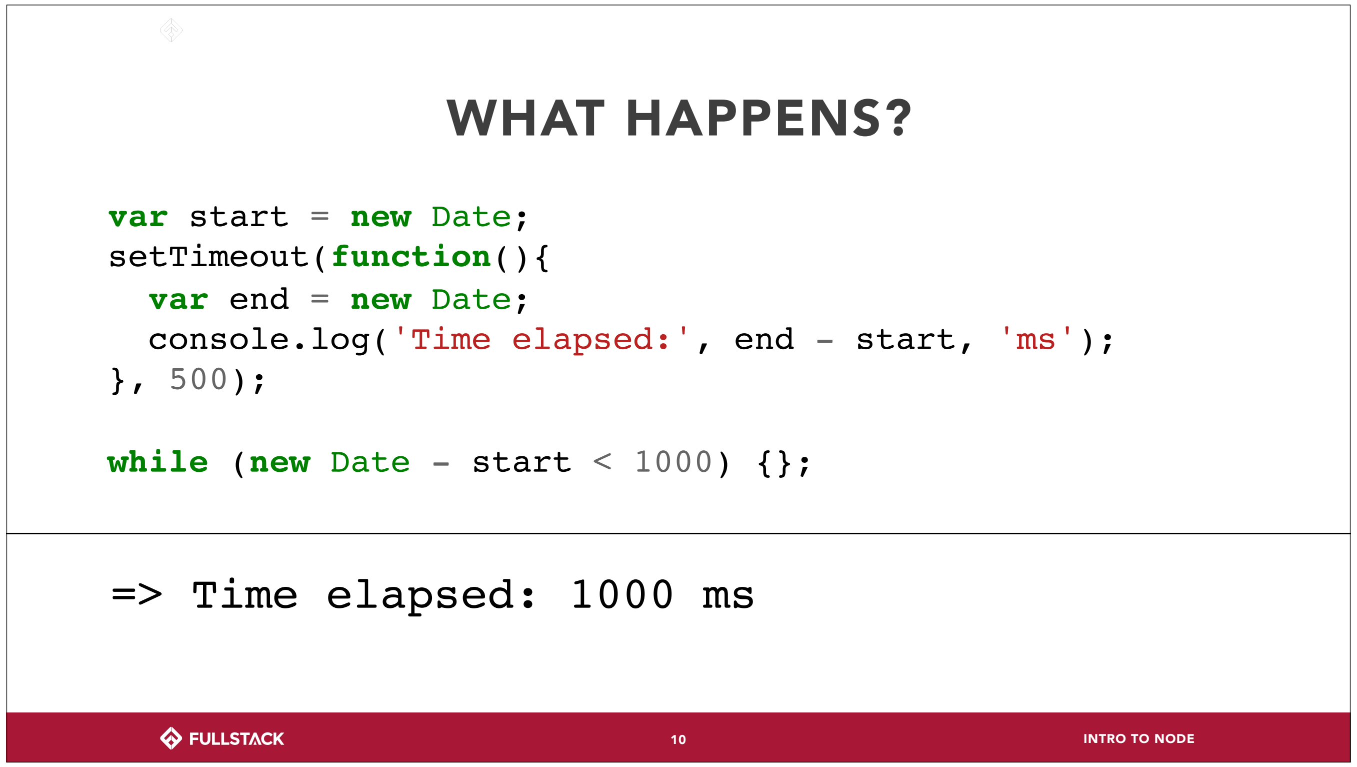
```
➡ console.log('Some callbacks');
  setTimeout(function(){
    console.log('you');
  }, 3000);
  console.log('love');
```

```
Some callbacks
love
(3000ms elapse)
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) {};
```

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

Pop quiz!

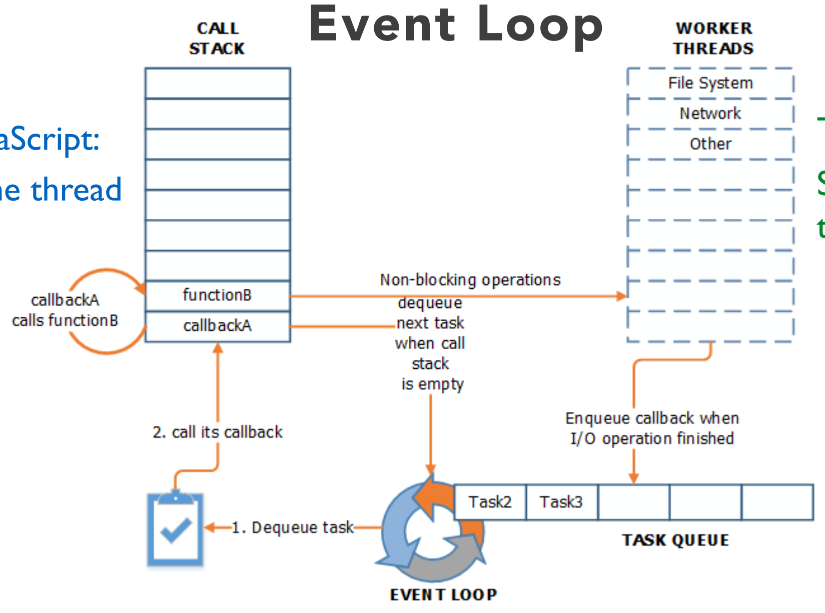
WHY?

```
var start = new Date;
setTimeout(function(){ // starts a timer and holds onto
  var end = new Date;  // the callback
  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

Recommended: watch event loop video. Demo on whiteboard with some simple code.

How do I know if a function is asynchronous?

That doesn't help

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

…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