# CIS 371 Web Application Programming

## JS|TS Promise

### Handling Asynchronous Results


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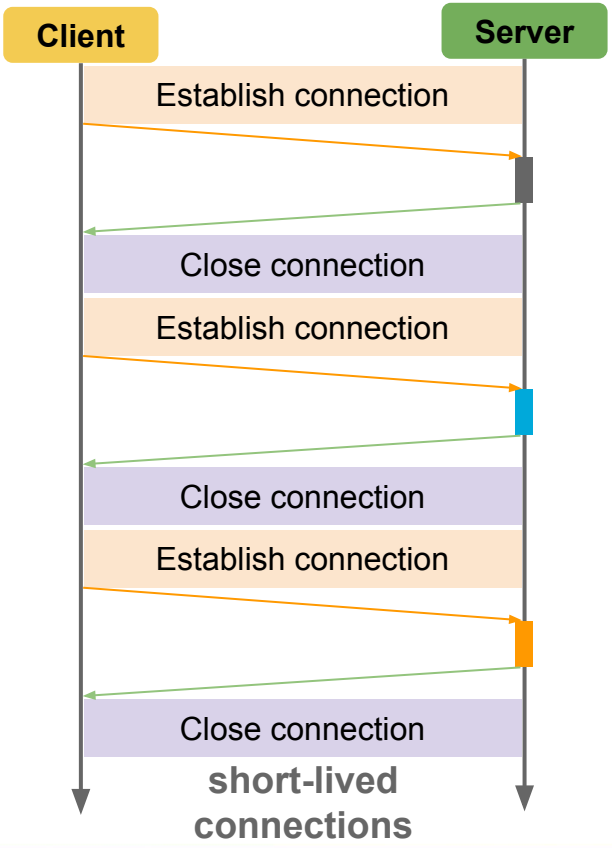
Based on the original version by Professor Hans Dulimarta.

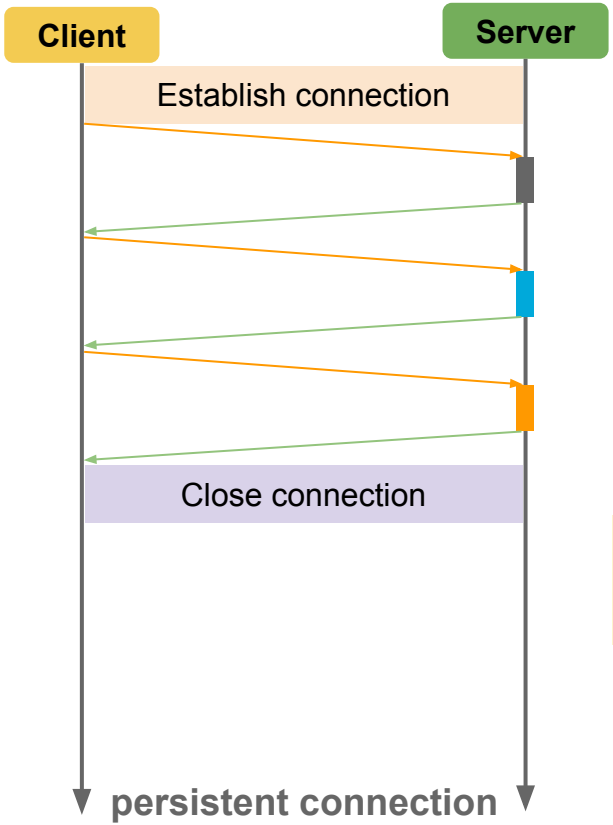
# Topics

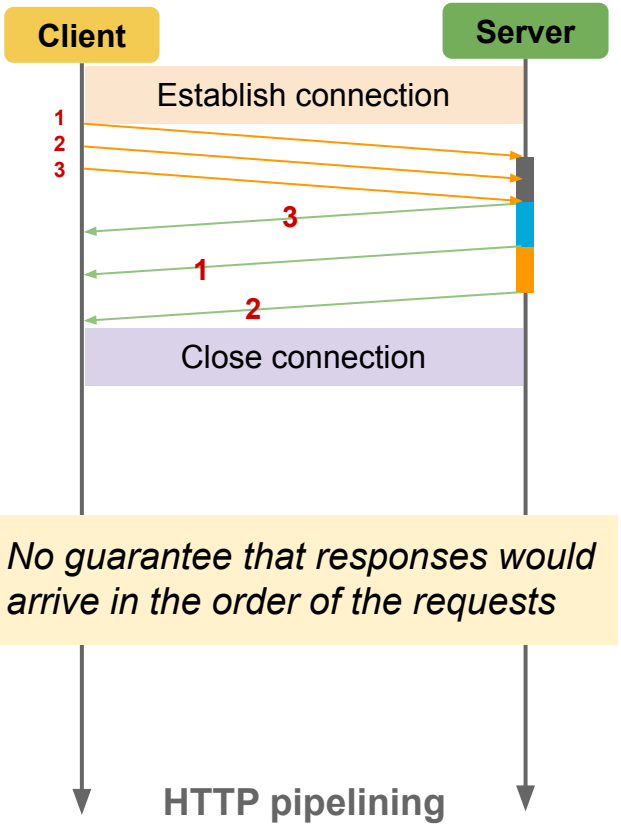
- Client/Server Communication
  - Synchronous
  - Asynchronous
- Callback functions (for handling asynchronous events)
- Promise

# Reference: Promise Documentation (@ MDN)

# Client/Server: HTTP Requests & Responses

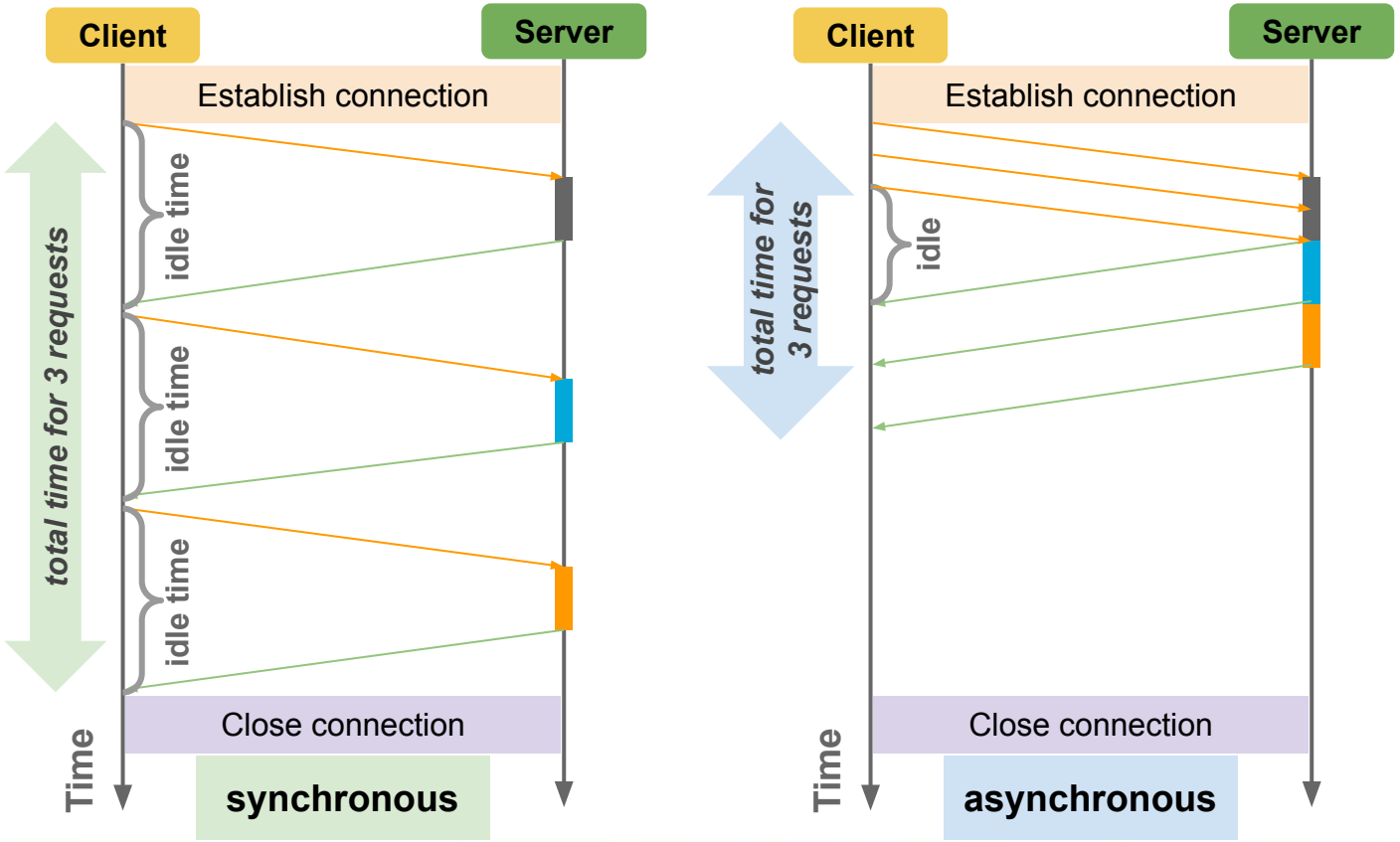


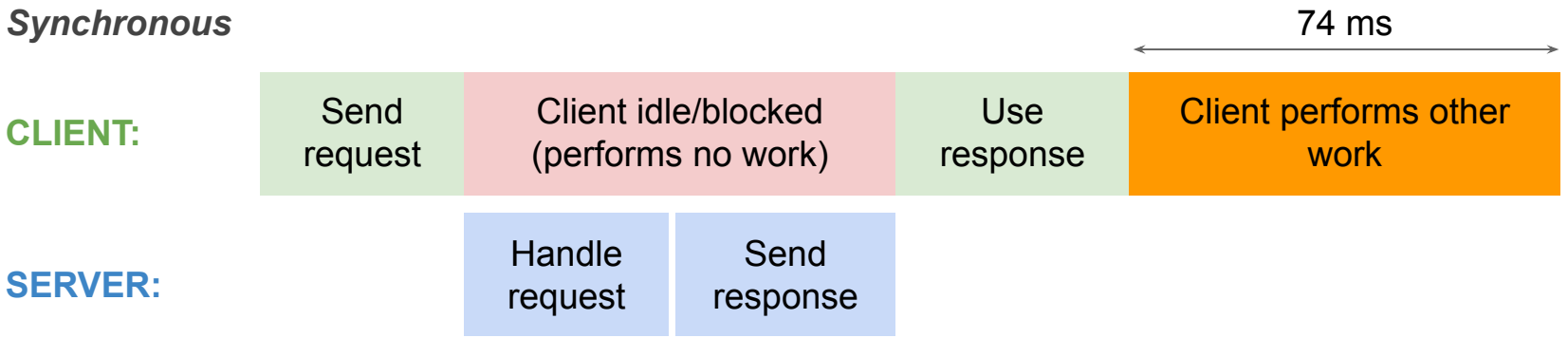



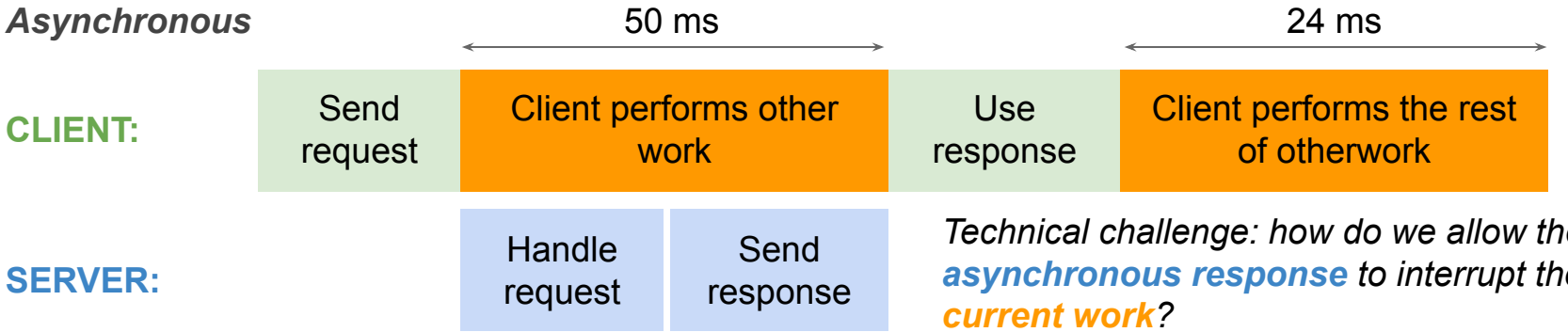

*No guarantee that responses would arrive in the order of the requests*

# Client/Server: HTTP Requests & Responses



# Synchronous vs. Asynchronous Requests




*Technical challenge: how do we allow the **server asynchronous response** to interrupt the **client current work**?*

**Sending Requests: easy**

**Receiving Async Responses: requires extra setup**

# Callback Actions
# (JS Callback Functions)

# You are number 17 in line.....

1-888-I-CAN-HELP

Would you like us to call you back?

*Option #1: without callback*

Dial → connect & extremely long wait → talk with tech support → watch movie

*Option #2: with callback*

Dial → short wait → watch movie → talk with tech support → resume movie

setup callback?

actual callback

# Synchronous Call (in code)

555-4321

1-888-I-CAN-HELP

Dial → connect & extremely long wait → talk with tech support → watch movie

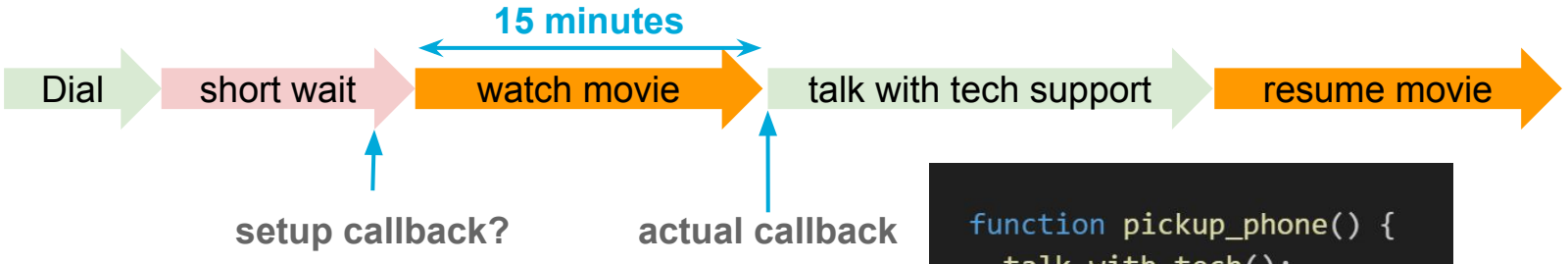
```
dial("888-I-CAN-HELP");
connect_and_long_wait();
talk_with_tech();
watch_movie();
```

# Async: “out-of-order” execution
# (Order of execution ≠order of line of code)

# Async Phone Calls with Callback (in code)

555-4321

1-888-I-CAN-HELP




```
dial("888-I-CAN-HELP");
setup_cb("555-4321", pickup_phone);
watch_movie();
```

```
function pickup_phone() {
  talk_with_tech();
}
```

*15 mins later*

*Asynchronous (incoming call) while you're watching movie*

# Callback fns (Fat Arrow)

```
function pickup_phone() {
  talk_with_tech();
}
dial("888-I-CAN-HELP");
setup_cb("555-4321", pickup_phone);
watch_movie();
```

*named function*

```
dial("888-I-CAN-HELP");
setup_cb("555-4321", () => {
  // 15 min later
  talk_with_tech();
});
watch_movie();
```

1 2 3 4 5

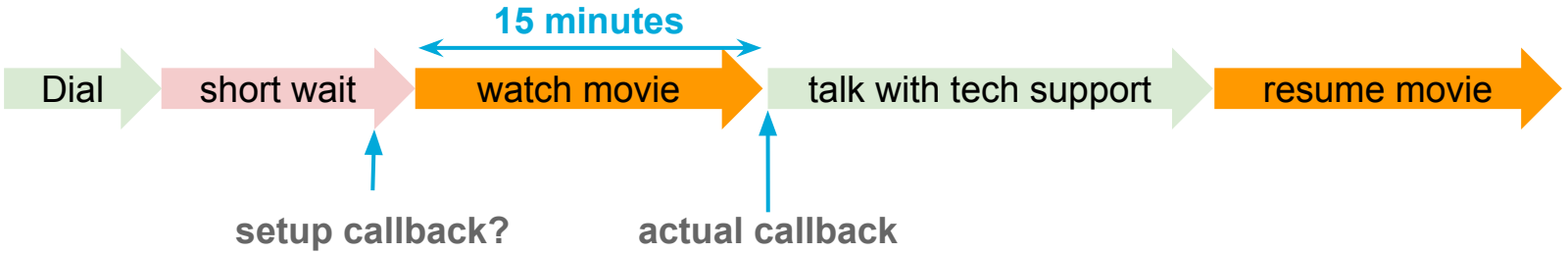
*fat arrow*

*Async: order of execution ≠ order of line of code*

```
// start dialing ...
dial("888-I-CAN-HELP"); 1
// call me back @ 555-4321
// then hangup to watch movie
setup_cb("555-4321", () => { 2
  // 15-min later
  talk_with_tech(); 4
});
// watch it NOW!!!
watch_movie(); 3     5
```

555-4321

1-888-I-CAN-HELP



# Tech: “But, you have to talk with my manager” (Nested Callback)

15 minutes

35 minutes

Dial → setup_cb → movie → talk with tech → setup_cb → resume movie → talk with mgr → resume

```
dial("888-I-CAN-HELP");                          1
setup_cb("555-4321", () => {                     2
  // 15-min later
  // Talk with tech                              4
  setup_cb("555-4321", () => {                   5
    // 37-min later
    // Talk with manager                         7
  });
});
watch_movie();                                   3  6  8
```

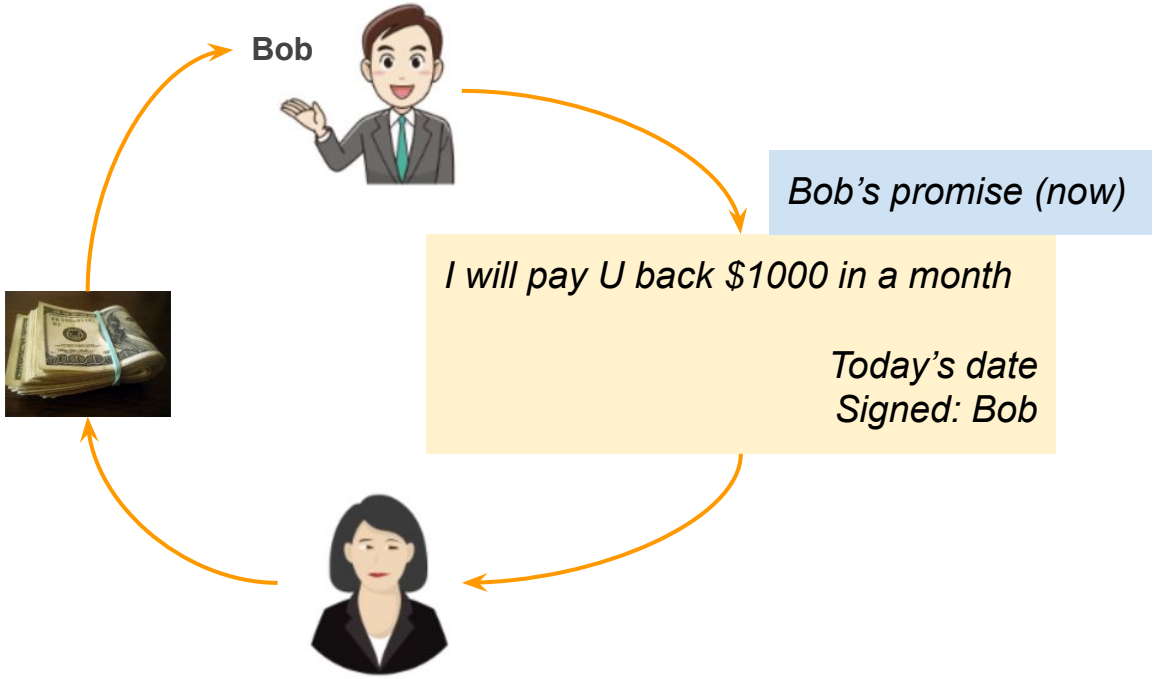
Nested callbacks

# How to Initiate Async HTTP Requests?

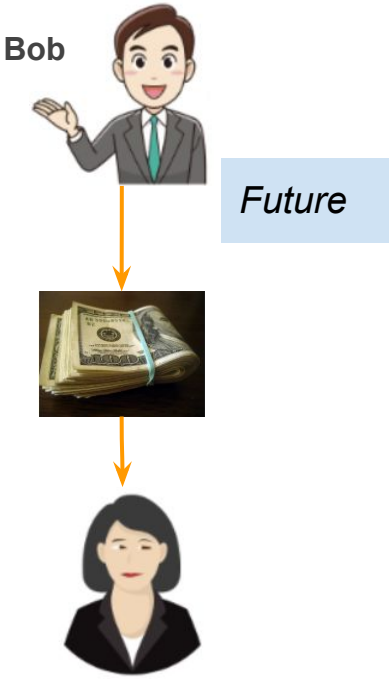
- fetch() function
  - Native in browser
  - NPM node-fetch
- Axios library
- Both fetch() and axios() use JS Promise

**IOU = I owe you note**
**Promise to pay debt/loan**

# Borrowing Money: Promise Now, Pay Later




Today (now): **Beth** receives a promise




1 month later (future): **Beth** receives cash

**A promise = now confirmation of future action(s)**
**A JS promise = a "now" object representing data which will become available in the future**

# Promise Example

```
function nthPrime(nth: number): Promise<number> {
  // work takes 10 seconds
  return Promise.resolve(_______);
}
```

```
function nthPrimeNow(nth: number): number {
  // work takes 10 seconds
  return _______;
}
```

```
console.log("Start");
const prom = nthPrime(500);
prom.then((pr: number) => {
  console.log("The 500th prime is", pr);
});
doMoreWork();
```

```
console.log("Start");
const pr = nthPrimeNow(500);
console.log("The 500th prime is", pr);
doMoreWork();
```

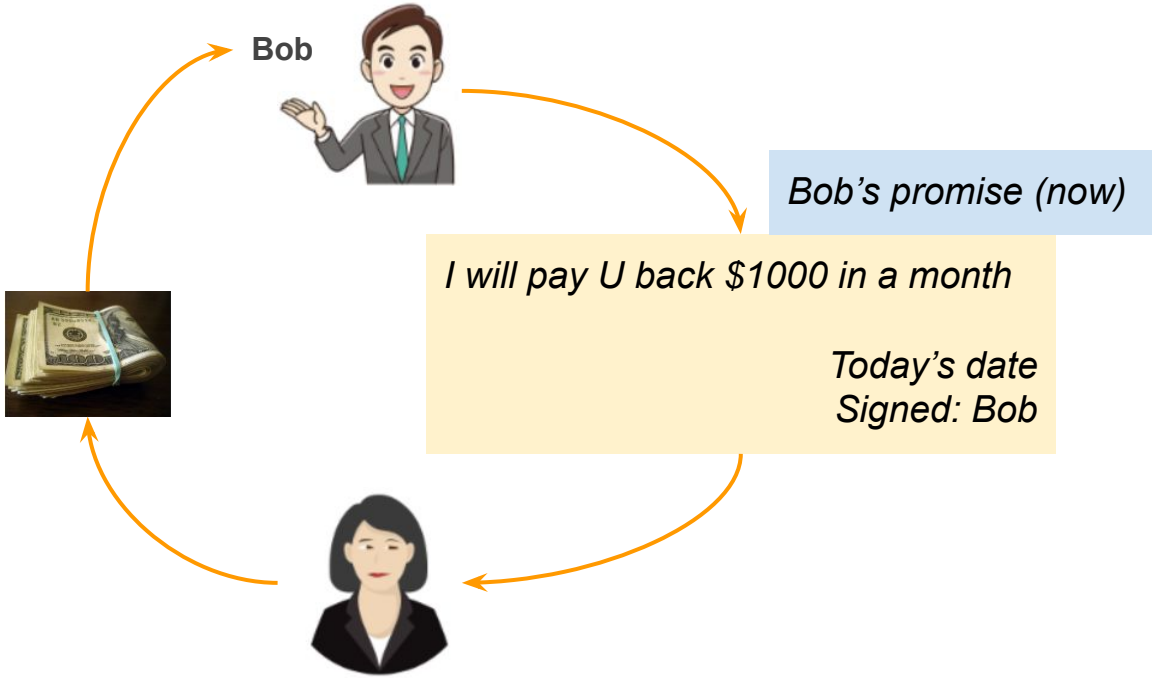
```
Start
Partial output of doMoreWork()
# After 10 seconds
The 500th prime is 3571
More output from doMoreWork()
```

*Compare the order of execution*

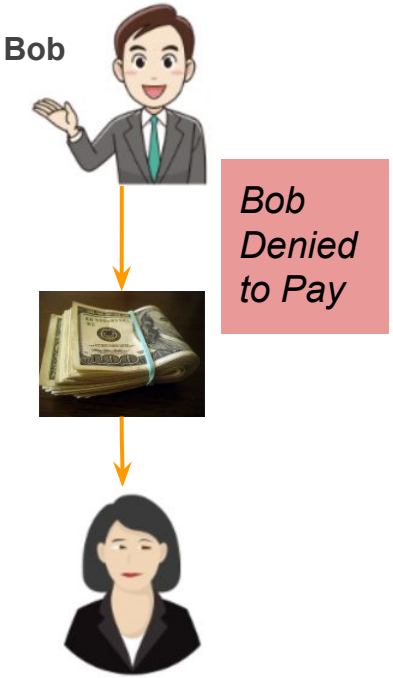
```
Start
# After 10 seconds
The 500th prime is 3571
Output of doMoreWork()
```

**Loan is either paid-off or defaulted**
**Promise is either resolved or rejected**

# Borrowing Money: Promise Now, Never Pay




Today (now): **Beth** receives a promise




1 month later (future): **Beth** gets none

# Promise settlement: resolve() or reject()

```
function nthPrime(nth: number): Promise<number> {
  if (nth < 100_000) {
    // assume prime calculation takes 10 seconds
    return Promise.resolve(a_prime_number_here);
  } else return Promise.reject("Can't compute prime");
}
```

```
console.log("Start");
nthPrime(500).then((pr: number) => {
  console.log("Prime is", pr);
});
.catch((err:any) => {
console.log("Rejected", err);
});
console.log("Here");
```

```
# Watch for order of execution
Start
Here
# if the promise is resolved
# After 10 seconds ...
Prime is 3571
# if the promise is rejected
Rejected Can’t compute prime
```