About ES6 Promises

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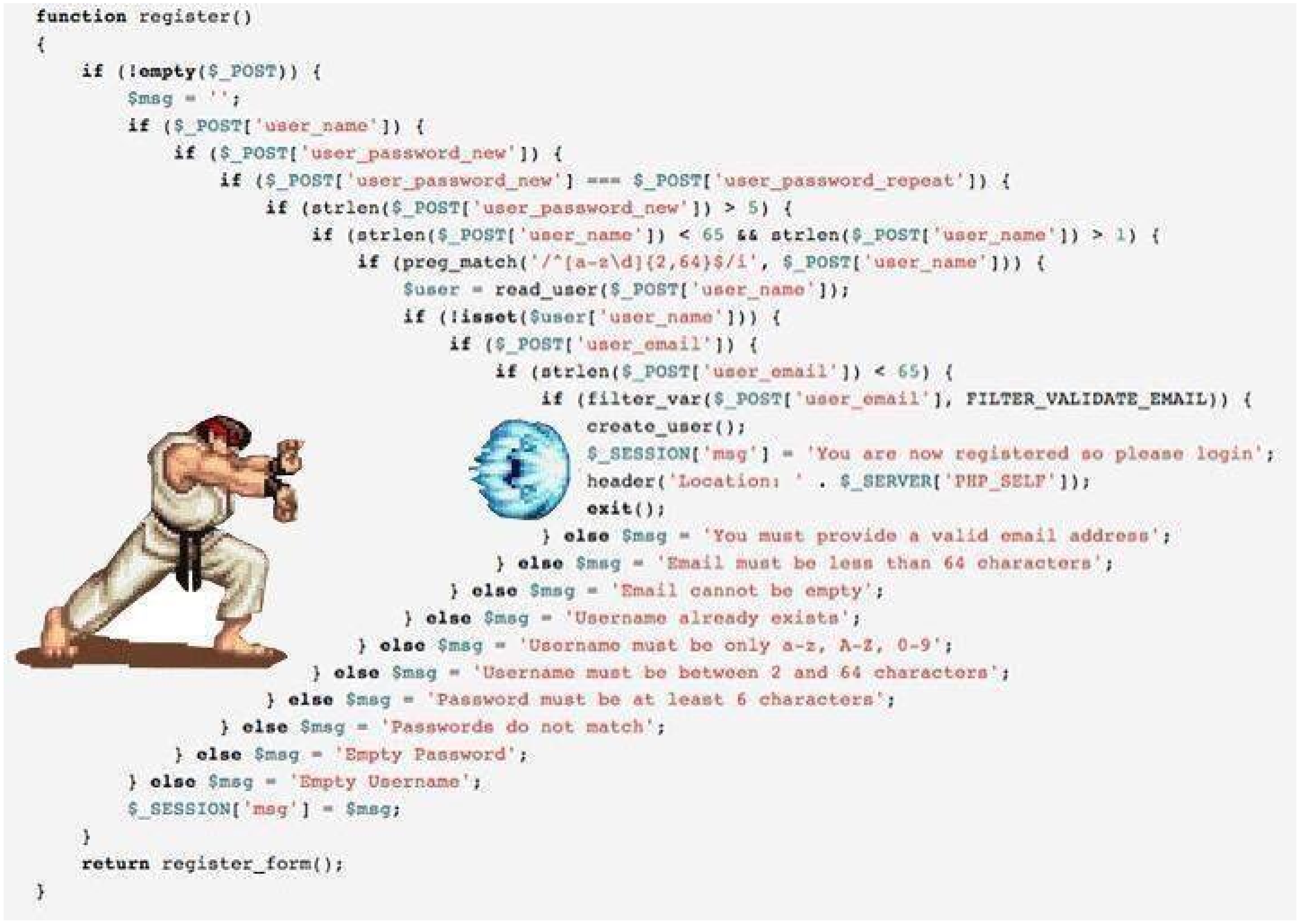
Why Promises?

Why Promises?

Hadoken code



```
function register()
{
    if (!empty($_POST)) {
        $msg = '';
        if ($_POST['user_name']) {
            if ($_POST['user_password_new']) {
                if ($_POST['user_password_new'] === $_POST['user_password_repeat']) {
                    if (strlen($_POST['user_password_new']) > 5) {
                        if (strlen($_POST['user_name']) < 65 && strlen($_POST['user_name']) > 1) {
                            if (preg_match('/^[a-z\d]{2,64}$/i', $_POST['user_name'])) {
                                $user = read_user($_POST['user_name']);
                                if (!isset($user['user_name'])) {
                                    if ($_POST['user_email']) {
                                        if (strlen($_POST['user_email']) < 65) {
                                            if (filter_var($_POST['user_email'], FILTER_VALIDATE_EMAIL)) {
                                                create_user();
                                                $_SESSION['msg'] = 'You are now registered so please login';
                                                header('Location: ' . $_SERVER['PHP_SELF']);
                                                exit();
                                            } else $msg = 'You must provide a valid email address';
                                        } else $msg = 'Email must be less than 64 characters';
                                    } else $msg = 'Email cannot be empty';
                                } else $msg = 'Username already exists';
                            } else $msg = 'Username must be only a-z, A-Z, 0-9';
                        } else $msg = 'Username must be between 2 and 64 characters';
                    } else $msg = 'Password must be at least 6 characters';
                } else $msg = 'Passwords do not match';
            } else $msg = 'Empty Password';
        } else $msg = 'Empty Username';
        $_SESSION['msg'] = $msg;
    }
    return register_form();
}
```

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Why Promises?

Compared to callback:

- Chaining is simpler
- Promise-based functions return results, they don’t continue execution via callbacks
    - The caller stays in control
- Cleaner signatures
    - With callbacks, the parameters of a function are mixed. With Promises all parameters are input
- Standardized
    - Before promises: Node.js callbacks, XMLHttpRequest, IndexedDB, etc

Why Promises?

One more reason: Trust

Why Promises?

Problems with callbacks

1. Call the callback more than once
2. Call the callback too early
3. Don’t call the callback
4. Errors could create a synchronous reaction whereas nonerrors would be asynchronous

This makes callbacks not very trustable in some cases.

Why Promises?

1) Call the callback more than once

→ Promises are resolved only once by definition

Why Promises?

2) Call the callback too early

→ The callback you provide to Promise instances then(..) method will always be called asynchronously

Why Promises?

3) Don’t call the callback

→ A timeout can be set using Promise.race(..)

Why Promises?

4) Errors could create a synchronous reaction whereas nonerrors would be asynchronous

→ Promises turn even JS exceptions (synchronous) into asynchronous behavior

What Is a Promise?

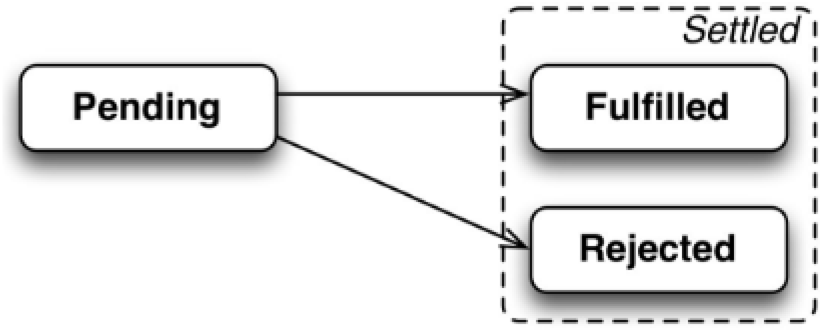
What Is a Promise?

A promise is a future value

Promise states

A Promise is always in one of three mutually exclusive states:

- Before the result is ready, the Promise is `pending`
- If a result is available, the Promise is `fulfilled`
- If an error happened, the Promise is `rejected`



Promise standard

`Promises/A+`

https://promisesaplus.com/

From now on I will speak about ES6 Native promises.

Promise standard

Famous Promise libraries

`bluebird`
https://github.com/petkaantonov/bluebird

`Q`
https://github.com/kriskowal/q

Producing a Promise

```
const p = new Promise(
    function (resolve, reject) { // (A)
        ...
        if (···) {
            resolve(value); // success
        } else {
            reject(reason); // failure
        }
    });
```

Consuming a Promise

Super rough basic usage

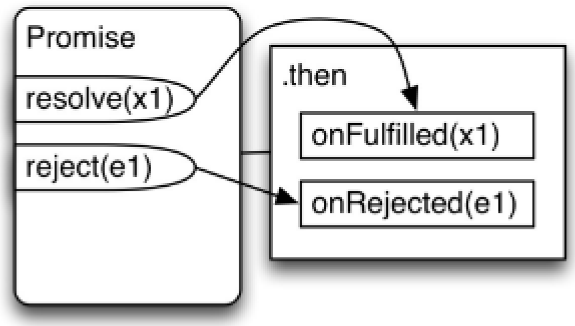
```
const promise = returnPromise();

promise.then(
  function fulfilled (result) {
    console.log(result);
  },
  function rejected () {
    // handle rejected promise
  }
);
```

Instance methods

`then()`

Accepts two callbacks parameters

- First parameter: called in case of resolve
- Second parameter: called in case of rejection



→ In case something different from a function is passed as parameter, that `then()` is ignored and the Promise chain continues.

Instance methods: `then()`

Always return a promise

```
const p = Promise.resolve(3)
  .then(x => {})
  .then(x => {
    console.log(x);
  });


p instanceof Promise // true
```

Instance methods: `then()`

Always return a promise

→ Return an empty resolved promise if there is no return

```
Promise.resolve(3)
  .then(x => {})
  .then(x => {
    console.log(x);
  });
```

Instance methods: `then()`

Always return a promise

→ If a normal result is returned, it is returned as a resolved promise

```
Promise.resolve(3)
  .then(x => {
    return 4;
  })
  .then(x => {
    console.log(x); // 4
  });
```

```
// same as code above
const p = Promise.resolve(3)
  .then(x => {
    return 4;
  });

// p contains a resolved promise with the value 4

p.then(x => {
  console.log(x); // 4
});
```

Instance methods: `then()`

Always return a promise

→ A fulfilled or rejected promise can be returned as well

```
Promise.resolve(3)
  .then(x => {
    return Promise.resolve(4);
  })
  .then(x => {
    console.log(x);
  });


Promise.resolve(3)
  .then(x => {
    return Promise.reject('ooops');
  })
  .then(x => {
    console.log(x);
  })
  .catch(e => {
    console.log(e);
  });
```

Instance methods: `then()`

Always return a promise

→ if an exception is thrown returns a rejected promise with the value

```
Promise.resolve(3)
  .then(x => {
    throw new Error('omg');
    return 4;
  })
  .then(
    x => {
     console.log(x);
    },
    e => {
     console.log(e);
    }
  );
```

Instance methods

`catch()`

`catch()` is simply a more convenient alternative to calling `then()`

```
promise.then(
    null,
    error => { /* rejection */ }
);
```

Above code is the same as the code below:

```
promise.catch(error => {
  /* rejection */
});
```

Instance methods

`done()` ?

`done()` is implemented in some libraries, but not in ES6 Promises at the moment.

Static methods

`Promise.all()`

Accepts an iterable as parameter.

Returns a Promise that:

- Is fulfilled if all elements in iterable are fulfilled
  - Fulfillment value: Array with fulfillment values
- Is rejected if any of the elements are rejected
  - Rejection value: first rejection value

Static methods: `Promise.all()`

```
Promise.all([
    asyncFunc1(),
    asyncFunc2()
  ])
  .then((results) => {
    ...
  })
  .catch(err => {
    // Receives first rejection among the Promises
    ...
  });
```

Static methods: `Promise.all()`

Native `Array.prototype.map()` can be used:

```
const fileUrls = [
    'http://example.com/file1.txt',
    'http://example.com/file2.txt',
];

const promisedTexts = fileUrls.map(httpGet);

Promise.all(promisedTexts)
  .then(texts => {
    for (const text of texts) {
      console.log(text);
    }
  })
  .catch(reason => {
    // Receives first rejection among the Promises
  });
```

Static methods

`Promise.race()`

Accepts an iterable as parameter.

The first element of iterable that is settled is used to settle the returned Promise.

```
Promise.race([
    httpGet('http://example.com/file.txt'),
    delay(5000).then(function () {
      throw new Error('Timed out')
    });
  ])
  .then(text => {
        ...
  })
  .catch(reason => {
    // Receives first rejection among the Promises
  });
```

Static methods

`Promise.resolve(x)`

Returns a Promise that is fulfilled with `x`.

`x` can be:

- Value
- Promise
- Thenable

Static methods: `Promise.resolve(x)`

If `x` is a value:

```
Promise.resolve('abc')
  .then(x => console.log(x)); // abc
```

Static methods: `Promise.resolve(x)`

If `x` is a Promise whose constructor is the receiver then x is returned unchanged:

```
const p = new Promise(() => null);

console.log(Promise.resolve(p) === p); // true
```

Static methods: `Promise.resolve(x)`

If `x` is a `thenable`, it is converted to a Promise.

→ *A* `thenable` *is an object that has a Promise-style then() method.*

Static methods: `Promise.resolve(x)`

`Promise.resolve(x)` makes sure we get a Promise result, so we can get a normalized, safe result we'd expect.

Static methods: `Promise.reject(err)`

Returns a Promise that is rejected with err:

```
const myError = new Error('Problem!');
Promise.reject(myError)
  .catch(err => console.log(err === myError)); // true
```

In the code below `p1` and `p2` have a rejected promise with the reason `'Ooops'`.

```
var p1 = new Promise( function(resolve,reject){
    reject('Oops');
} );

var p2 = Promise.reject('Oops');
```

Promise limitations

Sequence error handling

```
// `foo(..)`, `STEP2(..)` and `STEP3(..)` are
// all promise-aware utilities

var p = foo( 42 )
  .then( STEP2 )
  .then( STEP3 );

p.catch( handleErrors );
```

If any step of the chain in fact does its own error handling (perhaps hidden/abstracted away from what you can see), `handleErrors(..)` won't be notified.

Promise limitations

Single value

Promises by definition only have a single fulfillment value or a single rejection reason.

```
Promise.resolve(3)
  .then(x => {
    return [1, 2];
  })
  .then( function(msgs){
    const x = msgs[0];
    const y = msgs[1];

    console.log( x, y );
  });
```

```
Promise.resolve(3)
  .then(x => {
    return { a: 1, b: 2 };
  })
  .then(x => {
    const a = x.a;
    const b = x.b;
    console.log(a, b);
  });
```

Promise limitations

Single value

Using ES6 destructuring we can avoid some boilerplate :

```
Promise.resolve(3)
  .then(x => {
    return [1, 2];
  })
  .then(([x, y]) => {
    console.log(x, y);
  });
```

```
Promise.resolve(3)
  .then(x => {
     return { a: 1, b: 2 };
  })
  .then(({ a, b }) => {
    console.log(a, b);
  });
```

Promise limitations

Promise uncancelable

Once you create a Promise and register a fulfillment and/or rejection handler for it, there's nothing external you can do to stop that progression.

Compatibility Promises/callbacks in libraries

Many libraries have implemented compatibility with both Promises and callbacks.

As a convention, usually a Promise is returned if no callback is passed.

Compatibility Promises/callbacks in libraries

Example: Node.js MongoDB Driver API

```
collection.find().toArray((err, docs) => {
  if (err) {
    // err handling
  }
  console.log(docs):
});
```

```
collection.find().toArray().then(
    docs => { console.log(docs); },
    err => { // err handling }
  );
```

Quizes

Log Order?

```
const p = Promise.resolve()


p.then( function a() {
    p.then( function c() {
        console.log('C');
    } );
    console.log('A');
} );


console.log('D');


p.then( function b() {
    console.log('B');
} );


console.log('F');
```

Quizes

What is logged? (Part 1)

```
const doSomethingElse = () => {
  return Promise.resolve('hola');
};

const finalHandler = (message) => {
  console.log(message);
};
```

```
Promise.resolve()
  .then(() => {
    return doSomethingElse();
  })
  .then(finalHandler);
```

Quizes

What is logged? (Part 2)

```
const doSomethingElse = () => {
  return Promise.resolve('hola');
};

const finalHandler = (message) => {
  console.log(message);
};
```

```
Promise.resolve()
  .then(() => {
    doSomethingElse();
  })
  .then(finalHandler);
```

Quizes

What is logged? (Part 3)

```
const doSomethingElse = () => {
  return Promise.resolve('hola');
};

const finalHandler = (message) => {
  console.log(message);
};
```

```
Promise.resolve()
  .then(doSomethingElse())
  .then(finalHandler);
```

Quizes

What is logged? (Part 4)

```
const doSomethingElse = () => {
  return Promise.resolve('hola');
};

const finalHandler = (message) => {
  console.log(message);
};
```

```
Promise.resolve()
  .then(doSomethingElse)
  .then(finalHandler);
```

Quizes

What is the difference?

```
Promise.resolve('hola')
  .then(
    function fulfilled (msg) {
      msg.type.error;
      console.log(msg);
    },
    function rejected (err) {
      console.log('caught error:', err);
    }
  );
```

```
Promise.resolve('hola')
  .then(function fulfilled (msg) {
    msg.type.error;
    console.log(msg);
  })
  .catch(function rejected (err) {
    console.log('caught error:', err);
  });
```

Sources

- You Don't Know JS: Async & Performance (Kyle Simpson)
  https://github.com/getify/You-Dont-Know-JS/blob/master/async %26 performance/ch3.md
- Exploring ES6 (Axel Rauschmayer)
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- pouchdb blog: We have a problem with promises (Nolan Lawson)
  https://pouchdb.com/2015/05/18/we-have-a-problem-with-promises.html
- JavaScript reference documentation
  https://developer.mozilla.org/en/docs/Web/JavaScript/Reference/Global_Objects/Promise

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Thank you!

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