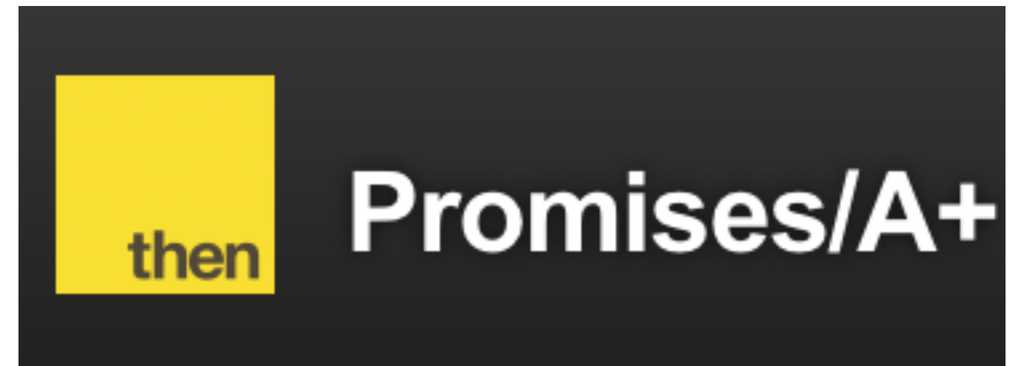
Callbacks & Promises



Agenda

- Task: read a JSON file
- A Callback Based Library (fs)
- A Promise based Libdary (fs-readfile-promise)
- Function Styles:
  - Anonymous function
  - Named function
  - Function Object
  - Named Arrow Function
  - Anonymous Arrow Function

Task: Read a JSON File

- Read a json file into a string variable
- Parse that file into a JavaScript Object
- Print out the Javascript Object
- Deal with errors in an orderly manner:
  - File not Found
  - File not Correct JSON format

users.json

```
[
  {
    "firstName": "Homer",
    "lastName": "Simpson",
    "email": "homer@simpson.com",
    "password": "secret"
  },
  {
    "firstName": "Marge",
    "lastName": "Simpson",
    "email": "marge@simpson.com",
    "password": "secret"
  },
  {
    "firstName": "Bart",
    "lastName": "Simpson",
    "email": "bart@simpson.com",
    "password": "secret"
  }
]
```

memory

```
▼ obj = Array[3]
  ▼ 0 = Object
      email = "homer@simpson.com"
      firstName = "Homer"
      lastName = "Simpson"
      password = "secret"
    ▶ __proto__ = Object
  ▼ 1 = Object
      email = "marge@simpson.com"
      firstName = "Marge"
      lastName = "Simpson"
      password = "secret"
    ▶ __proto__ = Object
  ▼ 2 = Object
      email = "bart@simpson.com"
      firstName = "Bart"
      lastName = "Simpson"
      password = "secret"
    ▶ __proto__ = Object
    length = 3
```

fs node module

- implicit mobile in node
- No need to ‘npm install’
- Provides Synchronous & Asynchronous version of most functions

File System

Stability: 2 - Stable

File I/O is provided by simple wrappers around standard POSIX functions. To use this module do `require('fs')`. All the methods have asynchronous and synchronous forms.

The asynchronous form always takes a completion callback as its last argument. The arguments passed to the completion callback depend on the method, but the first argument is always reserved for an exception. If the operation was completed successfully, then the first argument will be `null` or `undefined`.

When using the synchronous form any exceptions are immediately thrown. You can use try/catch to handle exceptions or allow them to bubble up.

Here is an example of the asynchronous version:

```
const fs = require('fs');

fs.unlink('/tmp/hello', (err) => {
  if (err) throw err;
  console.log('successfully deleted /tmp/hello');
});
```

Here is the synchronous version:

```
const fs = require('fs');

fs.unlinkSync('/tmp/hello');
console.log('successfully deleted /tmp/hello');
```

Simp

fs.readFile(file[, options], callback)

Added in: v0.1.29

- `file` <String> | <Buffer> | <Integer> filename or file descriptor
- `options` <Object> | <String>
  - `encoding` <String> | <Null> default = `null`
  - `flag` <String> default = `'r'`
- `callback` <Function>

Asynchronously reads the entire contents of a file. Example:

```
fs.readFile('/etc/passwd', (err, data) => {
  if (err) throw err;
  console.log(data);
});
```

The callback is passed two arguments `(err, data)`, where `data` is the contents of the file.

If no encoding is specified, then the raw buffer is returned.

If `options` is a string, then it specifies the encoding. Example:

```
fs.readFile('/etc/passwd', 'utf8', callback);
```

Any specified file descriptor has to support reading.

Note: If a file descriptor is specified as the `file`*, it will not be closed automatically.*

Anonymous Function

```
fs.readFile('users.json', function (error, text) {
  if (error) {
    console.error(error.message);
  } else {
    try {
      var obj = JSON.parse(text);
      console.log(obj);
    } catch (e) {
      console.error(err.message);
    }
  }
});
```

fs.readFile(file[, options], callback)

param 1

param 2

```
fs.readFile('users.json', function (error, text) {
  if (error) {
    console.error(error.message);
  } else {
    try {
      var obj = JSON.parse(text);
      console.log(obj);
    } catch (e) {
      console.error(err.message);
    }
  }
});
```

Named Function

```
function readFileSimple(error, text) {
  if (error) {
    console.error(error.message);
  } else {
    try {
      var obj = JSON.parse(text);
      console.log(obj);
    } catch (e) {
      console.error(err.message);
    }
  }
};
```

```
fs.readFile('users.json', readFileSimple);
```

param 1 param 2

fs.readFile(file[, options], callback)

Function Object

```
const readFileFunc = function (error, text) {
  if (error) {
    console.error(error.message);
  } else {
    try {
      var obj = JSON.parse(text);
      console.log(obj);
    } catch (err) {
      console.error(err.message);
    }
  }
};
```

```
fs.readFile('users.json', readFileFunc);
```

param 1 param 2

```
fs.readFile(file[, options], callback)
```

Named Arrow Function

```
const readFileArrow = (error, text) => {
  if (error) {
    console.error(error);
  } else {
    try {
      var obj = JSON.parse(text);
      console.log(obj);
    } catch (err) {
      console.error(err.message);
    }
  }
};
```

```
fs.readFile('users.json', readFileArrow);
```

param 1 param 2

```
fs.readFile(file[, options], callback)
```

fs.readFile(file[, options], callback)

param 1 param 2

```
fs.readFile('users.json', (error, text) => {
  if (error) {
    console.error(error);
  } else {
    try {
      var obj = JSON.parse(text);
      console.log(obj);
    } catch (err) {
      console.error(err.message);
    }
  }
});
```

Anonymous Arrow Function

callbackhell.com

```
fs.readdir('/Users', function (err, files) {
  if (err) {
    console.log('Error finding files: ' + err);
  } else {
    files.forEach(function (filename, fileIndex) {
      console.log(filename);
      gm(source + filename).size(function (err, values) {
        if (err) {
          console.log('Error identifying file size: ' + err);
        } else {
          console.log(filename + ' : ' + values);
          aspect = (values.width / values.height);
          widths.forEach(function (width, widthIndex) {
            height = Math.round(width / aspect);
            console.log('resizing ' + filename + 'to ' + height + 'x' + height);
            this.resize(width, height).write(dest + 'w' + width + '_' + filename, function (err) {
              if (err) console.log('Error writing file: ' + err);
            });
          }.bind(this));
        }
      });
    });
  }
});
```

- callbacks within callbacks within callbacks….
- unreadable and unmaintainable
- telltale ‘pyramid’ shape

Promises

- Promises provide a simpler alternative for executing, composing, and managing asynchronous operations when compared to traditional callback-based approaches.

- Gradually replacing Callbacks in many libraries and applications

- Implements a simpler and more robust pattern for asynchronous programming

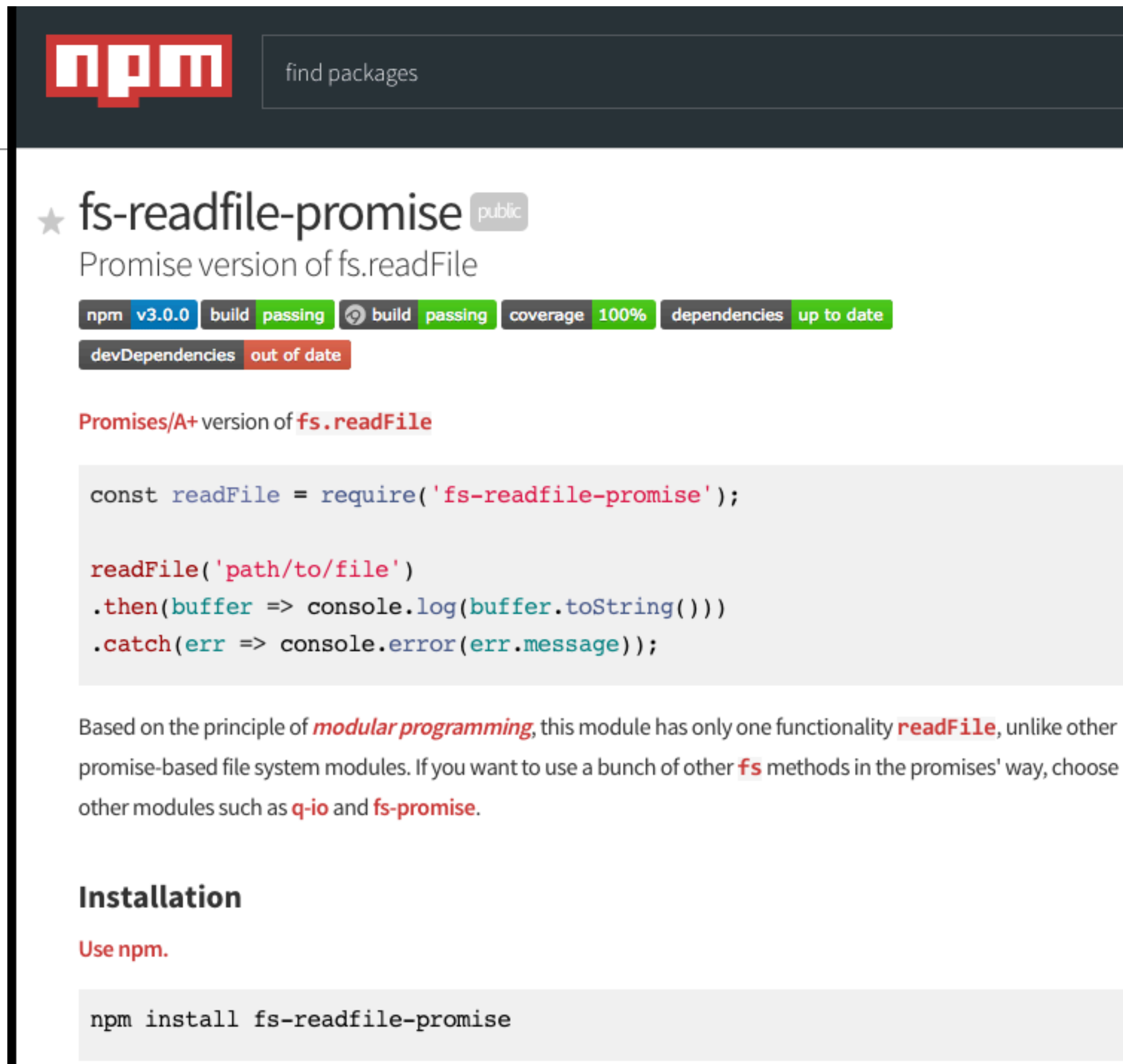
- Is seen as one solution to ‘Callback Hell’ problem

Promise States

- A promise can be in one of 3 states:
  - Pending - the promise's outcome hasn't yet been determined, because the asynchronous operation that will produce its result hasn't completed yet.
  - Fulfilled - the asynchronous operation has completed, and the promise has a value.
  - Rejected - the asynchronous operation failed, and the promise will never be fulfilled. In the rejected state, a promise has a reason that indicates why the operation failed.
- When a promise is pending, it can transition to the fulfilled or rejected state. Once a promise is fulfilled or rejected, however, it will never transition to any other state, and its value or failure reason will not change.

Promise Examples

- Library must support promises
- Or must be converted to use promises in some fashion (promisify techniques)




```
const readFile = require('fs-readfile-promise');
```

Callback

```
var fs = require('fs');

fs.readFile('users.json', function (error, text) {
  if (error) {
    console.error(error.message);
  } else {
    try {
      var obj = JSON.parse(text);
      console.log(obj);
    } catch (e) {
      console.error(err.message);
    }
  }
});
```

Promise

```
const readFile = require('fs-readfile-promise');

readFile('users.json')
    .then(text => {
      try {
        var obj = JSON.parse(text);
        console.log(obj);
      } catch (err) {
        console.error(err.message);
      }
    })
    .catch(err => {
      console.error(err.message);
    });
```

- In this small example, no major advantage to using promises
- However, as soon as callbacks become nested, then promises quickly become cleaner and simpler approach
- e.g: interacting with a database to lookup multiple objects, modify them and then save updates if no errors have occurred.

Promises - Function Objects/Promise Object

Standard Function Objects readSuccess & readFail

```
const readSuccess = function (text) {
  try {
    var obj = JSON.parse(text);
    console.log(obj);
  } catch (err) {
    console.error(err.message);
  }
};

const readFail = function (err) {
  console.error(err.message);
};
```

readFile returns a promise object

```
const promise = readFile('users.json');
```

install success and fail methods into promise

```
promise.then(readSuccess);
promise.catch(readFail);
```

Promises - Arrow Function/Promise Object

Standard Function Objects readSuccess & readFail

readFile returns a promise object

install success and fail methods into promise

```
const readSuccessArrow = text => {
  try {
    var obj = JSON.parse(text);
    console.log(obj);
  } catch (err) {
    console.error(err.message);
  }
};

const readFailArrow = err => {
  console.error(err.message);
};

const promise = readFile('users.json');


promise.then(readSuccess);
promise.catch(readFail);
```

Promises - Function Objects/Chaining

Standard Function Objects readSuccess & readFail

```
const readSuccess = function (text) {
  try {
    var obj = JSON.parse(text);
    console.log(obj);
  } catch (err) {
    console.error(err.message);
  }
};

const readFail = function (err) {
  console.error(err.message);
};

readFile('users.json')
    .then(readSuccess)
    .catch(readFail);
```

install success and fail methods into promise directly (chaining)

Promises - Arrow Functions/Chaining

Standard Function Objects readSuccess & readFail

```
const readSuccessArrow = text => {
  try {
    var obj = JSON.parse(text);
    console.log(obj);
  } catch (err) {
    console.error(err.message);
  }
};

const readFailArrow = err => {
  console.error(err.message);
};
```

install success and fail methods into promise directly (chaining)

```
readFile('users.json')
    .then(readSuccess)
    .catch(readFail);
```

Promises - Anonymous Arrow Functions

```
const readFile = require('fs-readfile-promise');

readFile('users.json')
    .then(text => {
      try {
        var obj = JSON.parse(text);
        console.log(obj);
      } catch (err) {
        console.error(err.message);
      }
    })
    .catch(err => {
      console.error(err.message);
    });
```