KINGSLAND UNIVERSITY

Streams and Utilities

Streams, Pub/Sub Pattern, Events, FS Module

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Have a Question?

#js-web

Streams

Streams, Buffers and Chunks

Streams

- **Collections of data** that is not available at once
  - Data may come **continuously** in **chunks**
- Types
  - **Readable** - can only be read (process.stdin)
  - **Writeable** - can only be written to (process.stdout)
  - **Duplex** - both Readable and Writeable (TCP sockets)
  - **Transform** - the output is computed from the input (zlib, crypto)

Readable Stream

- Functions
  - **`read()`** - get chunks from the stream
  - **`resume()`** - switch to **flowing** mode
  - **`pause()`** - switch to **paused** mode
- Events - used when the stream is **flowing**
  - **`data`** - chunk is available for reading
  - **`end`** - no more data
  - **`error`** - an exception has occurred

Readable Stream (2)

- **HTTP Request** is a readable stream

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

http.createServer((req, res) => {
  if (req.method === 'POST') {
    let body = '';
    req.on('data', data => { body += data });
    req.on('end', () => {
      console.log(body);
    });
  }
}).listen(5000);
```

Writable Stream

- Functions
  - **`write()`** - send chunks to the stream
  - **`end()`** - close the stream
- Events
  - **`drain`** - stream can receive more data
  - **`finish`** - all data has been flushed (buffer is empty)
  - **`error`** - an exception has occurred

Writable Stream (2)

- **HTTP Response** is a writeable stream

```
const fs = require('fs');
const server = require('http').createServer();

server.on('request', (req, res) => {
  const src = fs.createReadStream('./bigfile.txt');
  src.on('data', data => res.write(data));
  src.on('end', () => res.end());
});

server.listen(5000);
```

Piping Streams

- The **pipe()** function allows a readable stream to **output directly** to a writable stream
  - **Event listeners** are automatically added

```
const fs = require('fs');
const server = require('http').createServer();

server.on('request', (req, res) => {
  const src = fs.createReadStream('./bigfile.txt');
  src.pipe(res);
});
server.listen(5000);
```

Duplex and Transform Streams

- **Duplex** stream
  - Implements both the **Readable** and **Writeable** interfaces
  - Example - a TCP socket
- **Transform** stream
  - A special kind of duplex stream where the output is a **transformed** version of the input
    - http://codewinds.com/blog/2013-08-20-nodejs-transform-streams.html

Streams

- Transforms with Gzip

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

let readStream = fs.createReadStream('index.js');
let writeStream = fs.createWriteStream('index.js.gz');

let gzip = zlib.createGzip();

readStream.pipe(gzip).pipe(writeStream);
```

- https://nodejs.org/dist/latest-v6.x/docs/api/zlib.html#zlib_compressing_http_requests_and_responses

File Upload

- Using **formidable** to **upload files**

```
let form = new formidable.IncomingForm();

form.parse(req, (err, fields, files) => {
  if (err) {
    console.log(err);
    return;
  }
  console.log(fields);
  console.log(files);
})
```

- Do not forget the **enctype**!

Publish-Subscribe Pattern

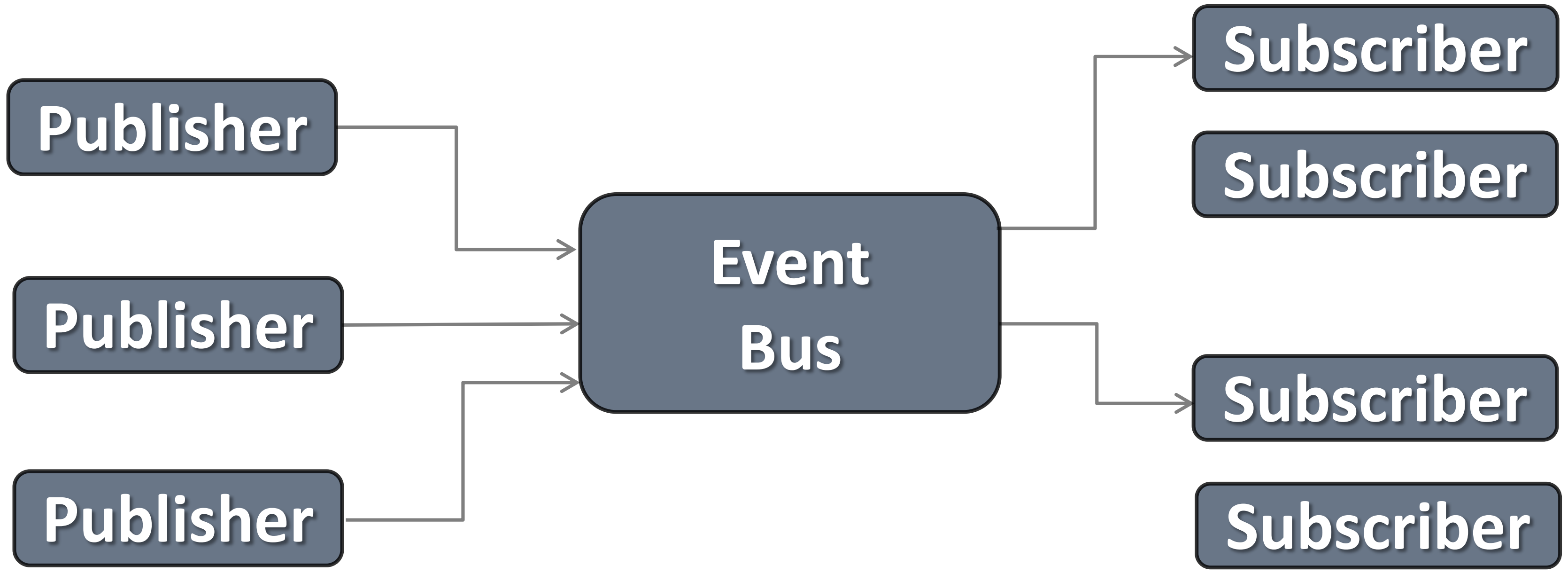
Messaging Pattern

What is Pub/Sub?

- Used to **communicate messages** between different system components without them knowing anything about each other's **identity**
  - **Senders** (publishers), do not program the messages to be sent directly to specific **receivers** (subscribers)
  - Subscribers express interest in **one or more events**, and only **receive messages** that are of **interest**

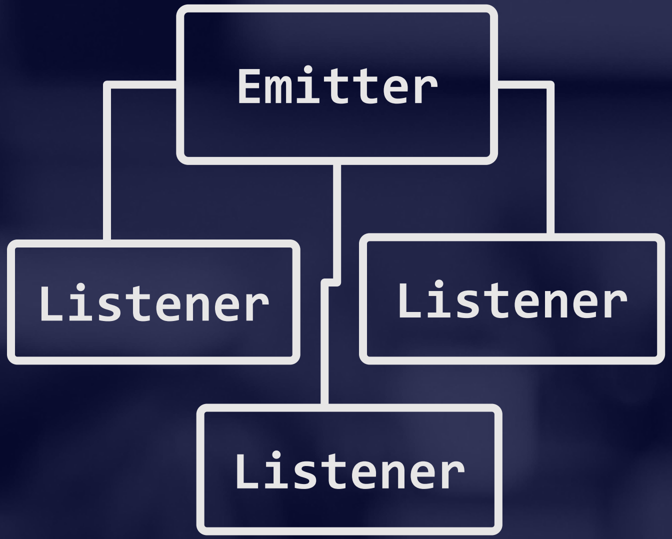
Pub/Sub Example

- An **intermediary** (called a "**message broker**" or "**event bus**")
  - Receives **published** messages
  - Forwards them to the **subscribers** who are registered to receive them



Advantages

- Eliminate Polling
  - Promotes **faster response time** and **reduces the delivery latency**
- Dynamic Targeting
  - Makes discovery of services easier, more natural and **less error prone**
- Decouple and Scale Independently
  - Makes software more **flexible**
- Simplify Communication
  - Reduces complexity by **removing** all the **point-to-point connections** with a single connection



Events

Emit Your Data

Events

- Require module "**events**"

```
const events = require('events');
let eventEmitter = new events.EventEmitter();

eventEmitter.on('click', (a, b) => {
  console.log('A click has been detected!');
  console.log(a + ' ' + b); // outputs 'Hello world'
});

eventEmitter.emit('click', 'Hello', 'world');
```

- Events are **not** asynchronous

FS Module

Working with the File System

Working with the File System

- The **fs** module gives you access to the

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

- All functions have **synchronous** and **asynchronous** variants

```
let data = fs.readFileSync('./package.json', 'utf8');
console.log(data);
```

```
let data = fs.readFile('./package.json', 'utf8',
(err, data) => {  // Handle possible errors
  console.log(data); });
```

Working with the File System (2)

- **List** files in a directory

```
let data = fs.readdirSync('./myDir', 'utf8');
console.log(data);
```

```
let data = fs.readdir('./myDir', 'utf8', (err,
data) => {
  if (err) {
    console.log(err);
    return;
  }
  console.log(data);
});
```

The result is an **array of strings**, containing all filenames

Working with the File System (3)

- **Create** a directory

```
fs.mkdirSync('./myDir');
```

```
fs.mkdir('./myDir', err => {
  if (err) {
    console.log(err);
    return;
  }
});
```

Working with the File System (4)

- **Rename** file or directory

```
fs.renameSync('./oldName', './newName');
```

```
fs.rename('./oldName', './newName', err => {
  if (err) {
    console.log(err);
    return;
  }
});
```

Working with the File System (5)

- **Write** a file

```
const fs = require('fs');
let filePath = './data.txt';
let data = 'Some text';
```

```
fs.writeFileSync(filePath, data);
```

```
fs.writeFile(filePath, data, err => {
  if (err) {
    console.log(err);
    return;
  }
});
```

Working with the File System (6)

- **Delete** file

```
fs.unlinkSync('./target.txt');
```

```
fs.unlink('./target.txt', err => {
  if (err) {
    console.log(err);
    return;
  }
});4
```

Working with the File System (7)

- **Delete** directory

```
fs.rmdirSync('./myDir');
```

```
fs.rmdir('./myDir', err => {
  if (err) {
    console.log(err);
    return;
  }
});
```

- Full API docs: https://nodejs.org/api/fs.html

Debugging

Inspectors and Watchers

Debugging & Watching in Node.js

- Debugging in Node.js
  - The V8 **debug protocol** is a **JSON** based protocol
- **IDEs** with a debugger
  - Webstorm
  - Visual Studio
  - Node-inspector (not working with latest version)
- Watching with **Nodemon**

Live Exercises

Summary

- Node.js has various useful **utility** modules
- **Streams** allow working with **big data**
- **Events** simplify **communication** within a large
  application
- **Pub/Sub** pattern is used to **communicate messages**
- The **`fs`** module gives you access to the **file system**

Questions?

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