

Streams and Utilities

Streams, Pub/Sub Pattern, Events, FS Module



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#js-web

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Publish-Subscribe Pattern

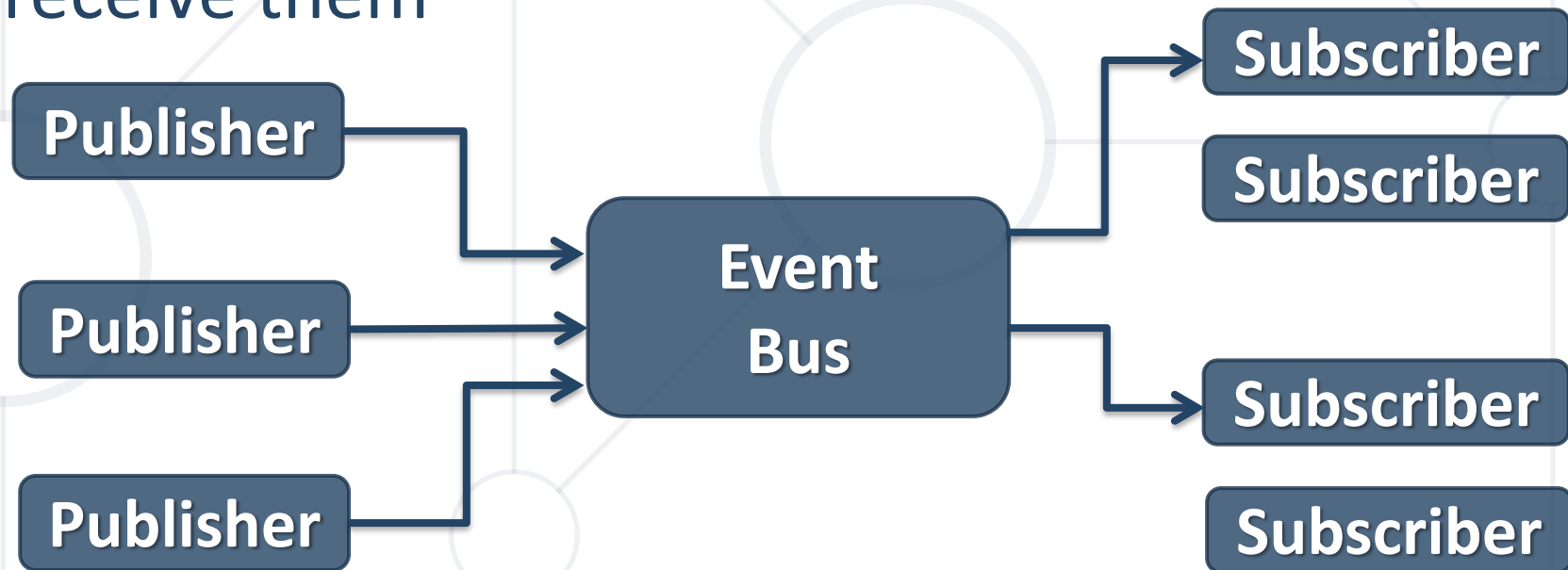
What is Pub/Sub?



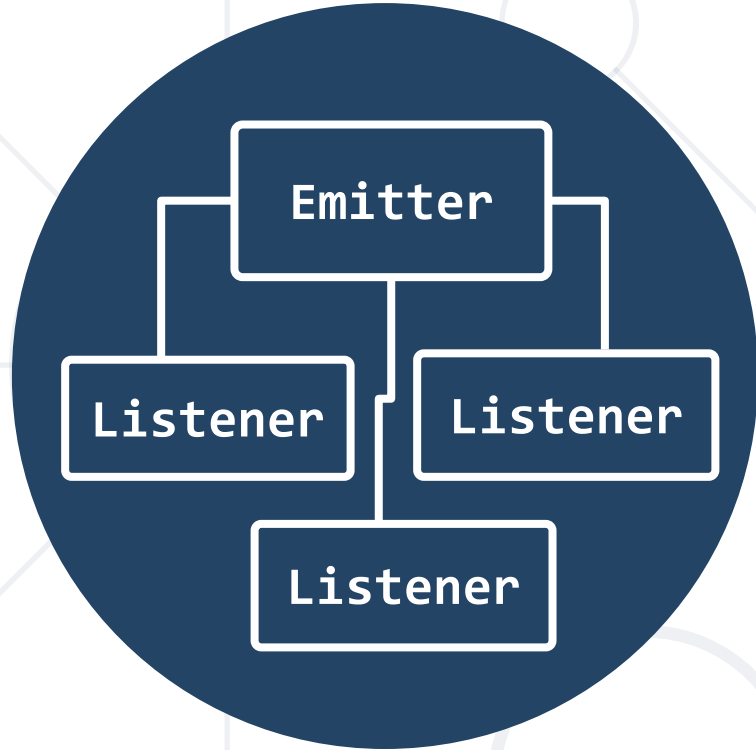
- Used to **communicate messages** between different system components without them knowing anything about each other's **identity**
 - **Senders** (publishers), do not program the messages to be sent directly to specific **receivers** (subscribers)
 - Subscribers express interest in **one or more events**,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




- Decouple and Scale Independently
 - Makes software more **flexible**
- Eliminate Polling
 - Promotes **faster response time** and **reduces the delivery latency**
- Simplify Communication
 - Reduces complexity by **removing** all the **point-to-point connections** with a single connection



Events

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



Streams

Streams

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



Readable Stream

- Functions
 - **read()** - get chunks from the stream
 - **pause()** - switch to **paused** mode
 - **resume()** - switch to **flowing** 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

- **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

- **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 **Writable** 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
 - <https://nodejs.org/api/zlib.html>

```
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);
```





FS Module

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

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

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

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

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

Working with the File System

- **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

- **Create** a directory

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

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



Working with the File System

- **Delete** directory

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

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

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



Working with the File System

- **Rename** file or directory

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

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



Working with the File System

- **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

- Delete file

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

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





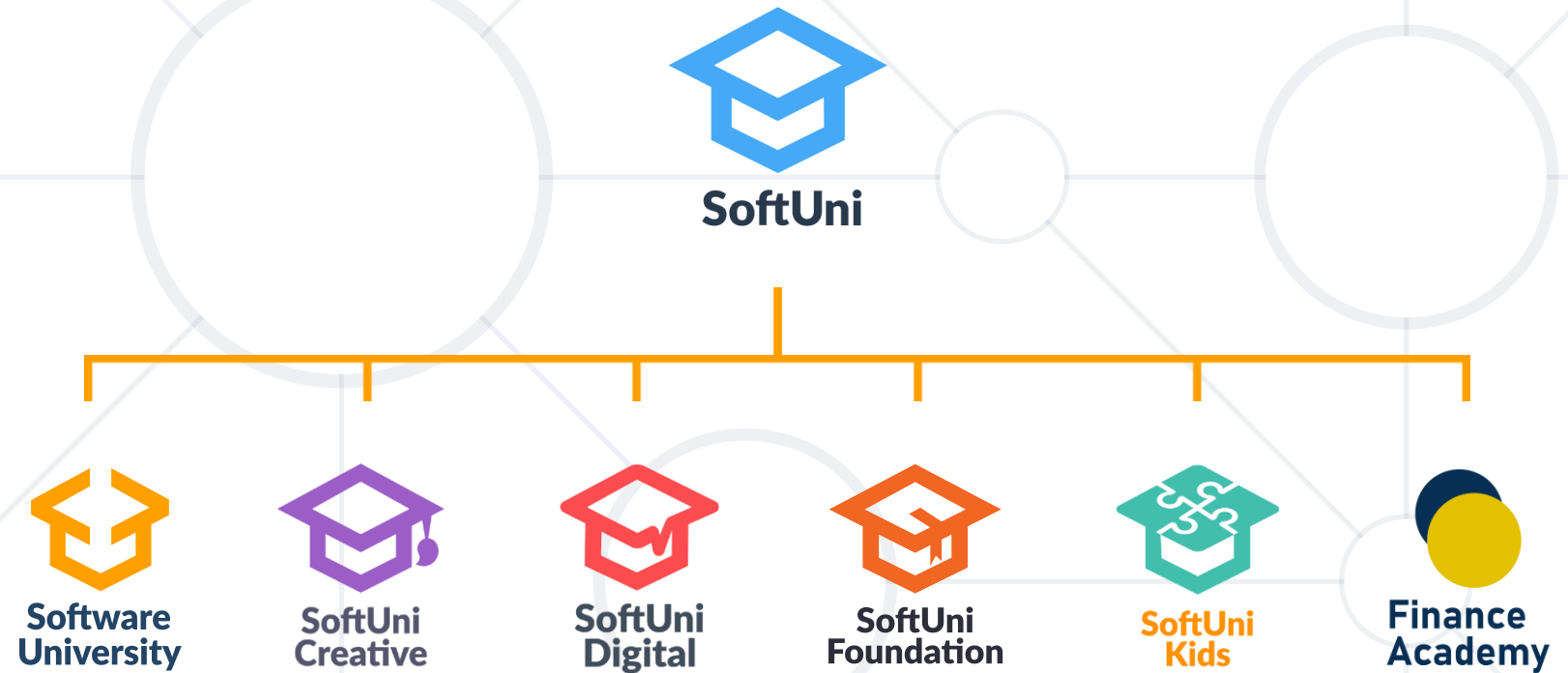
Debugging

- 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**

- 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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