JavaScript Tooling

tl;dr

- Modern JavaScript development requires a ton of libraries which in turn requires the use of a lot of tools:
  - npm - organizes libraries and automates the build
  - linters - reports bad code practices
  - unit testers - run automated test scripts
  - webpack - minifies, bundles, and automates the build
  - babel or typescript - transpiles to allow all code to run universally

Web development in the 90's

- 90's JavaScript development looked like this:
- Write a series of HTML pages
- Write a JavaScript file to handle DOM manipulation
- All data reads/writes would require a request to the server for a new page

Web development in the 2000's

- jQuery!
- Write a series of HTML pages
- Download jQuery.js and put in the root of your site.

```
<script src="jquery.js"></script>
```

- Write a JavaScript file to handle DOM manipulation through jQuery
- Make occasional Ajax requests with jQuery

Web development in the 2010s

- backbone, ember, angularJS!
- Write a series of HTML pages
- Download your library

```
<script src="angular.js"></script>
```

- Let angularJS handle your DOM manipulation and Ajax.
- Write a JavaScript file to deal with Model and Controller
- We occasionally have a SPA

In come the libraries!

- Tools - Datejs, Sylvester, Dojo, Moo
- Graphing libraries - jsCharts, D3, Raphael
- Animation - $fx, jsTweener
- Asynchronous JS - q.js, promises
- Component libraries - jQueryUI, et. al.
- Browser detection and polyfills- Modernizr
- Forms - wForms, qForms, formReform
- Layout - Bootstrap, grid360

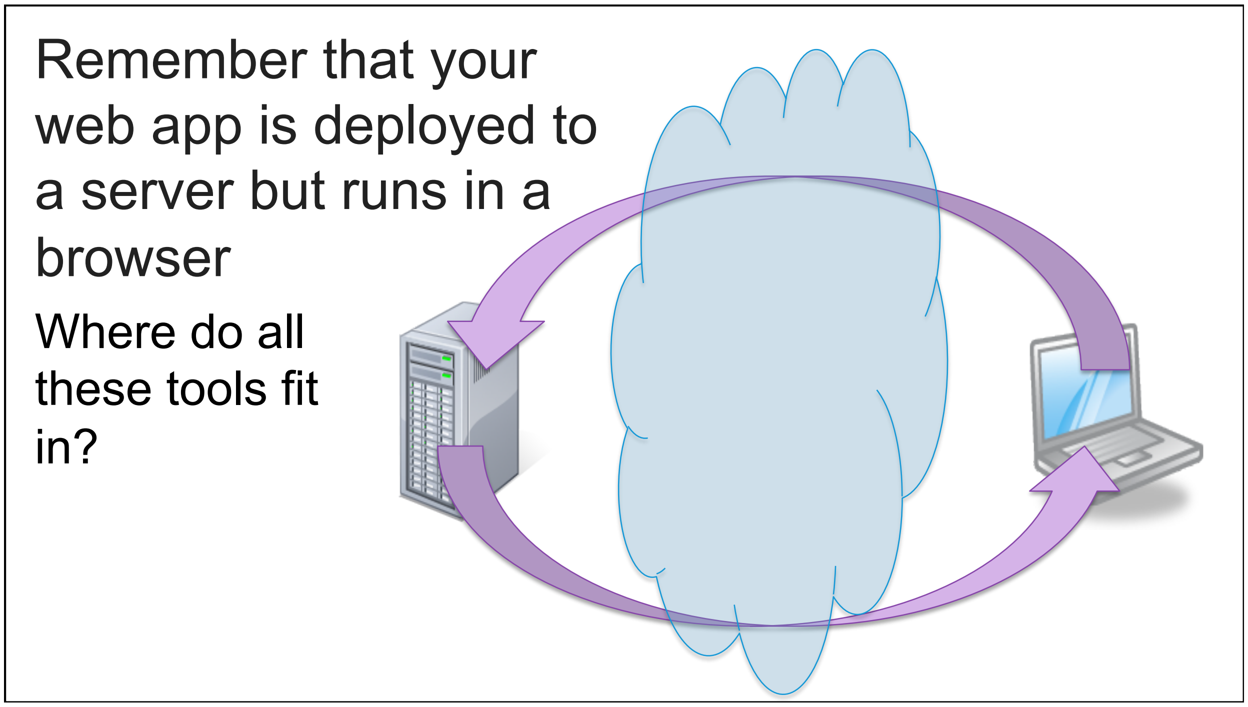
Modern web development involves frameworks that require a lot of care

These are nearly impossible to set up without develop without tooling.

- Modern JavaScript development involves libraries
- Tons!
- Tons of libraries means that have to be pre-processed
- This means either extra work for you or
- Lots of tooling!
- This chapter is about that tooling

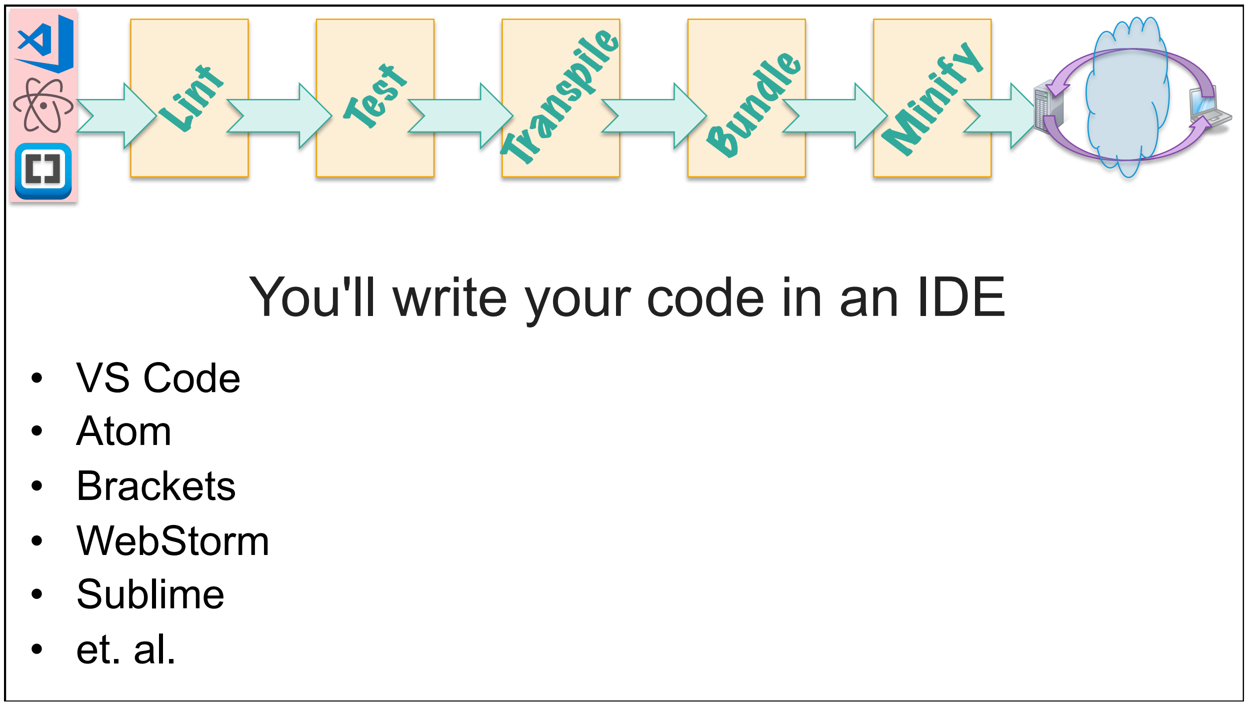
Problems and solutions

- There are lots of libraries we will use. Versions are important. - package managers
- We should unit test everything - testing suites
  - Test runners
  - Frameworks
  - Assertion libraries
- They are big. - minifiers
- Too many fetches - bundlers
- JavaScript needs new features added to it but the browsers don't understand them - transpilers
- Error-prone and time-consuming to run all these - Task runners



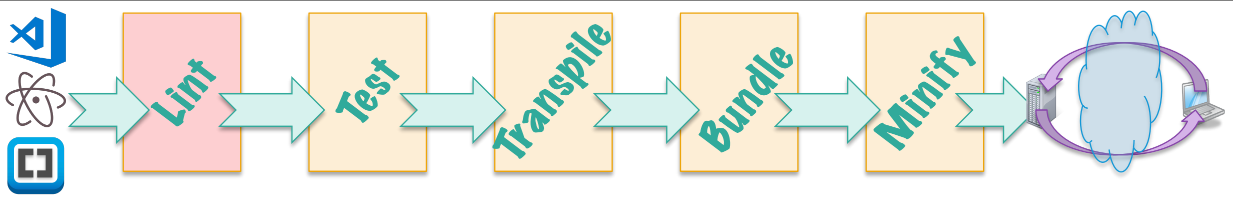
Remember that your web app is deployed to a server but runs in a browser

Where do all these tools fit in?



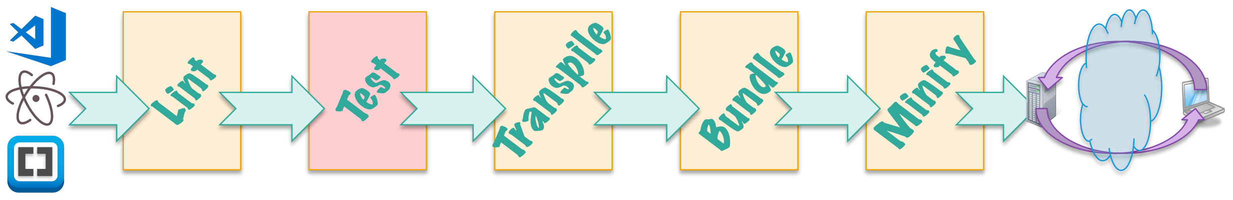
You'll write your code in an IDE

- VS Code
- Atom
- Brackets
- WebStorm
- Sublime
- et. al.



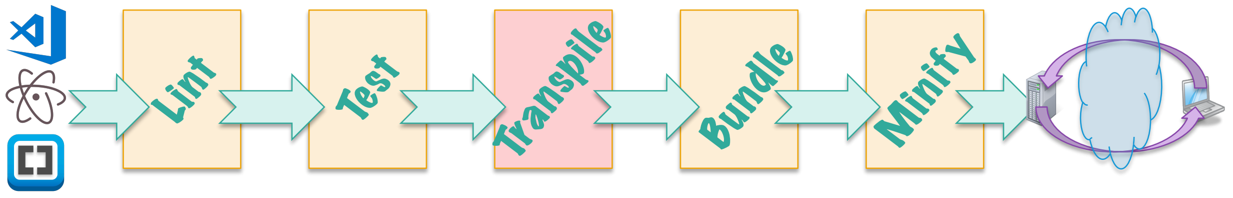
Lint

- Tell you when your code is not following best practices.
- Helps to maintain high code quality.
- ESLint - Newer and better
- JSHint -
- JSLint - Older. Rules are built-in.



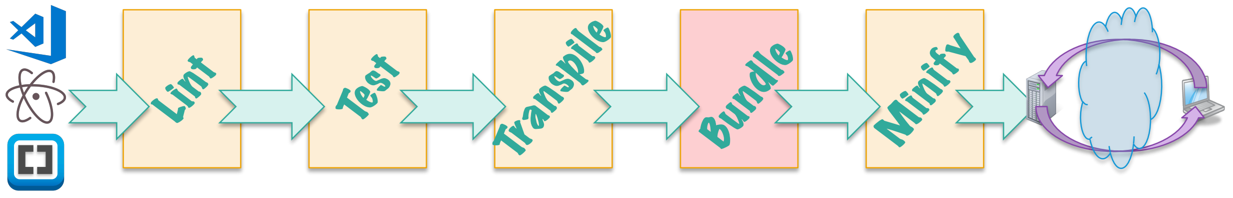
Test

- Automated tests are made of unit tests and integration tests
- If we need a browser, it's called a UI test or e2e test
- Much more about this step later!



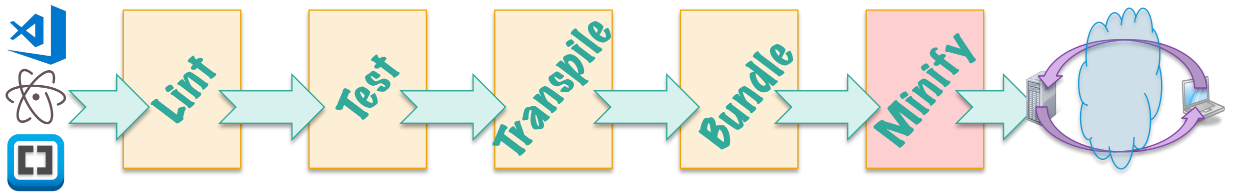
Transpile

- Convert one type of JavaScript to another
- Babel - ES2018 to ES5
- TypeScript - Proprietary dialect to ES5
- Traceur - ES2015-to-ES5
- CoffeeScript - Proprietary dialect to ES5



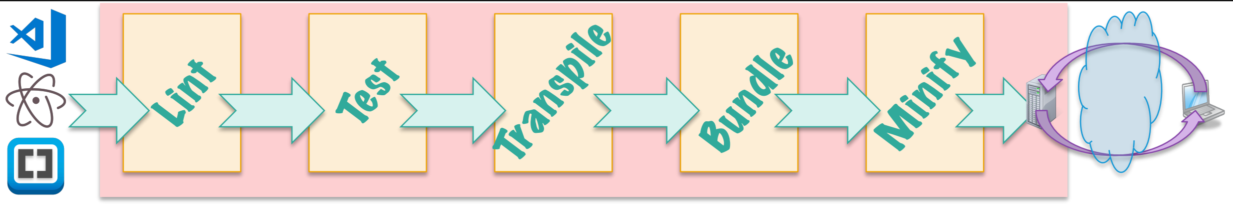
Bundle

- Normally we'd list a boatload of <script> tags in the <head>
- Each of those fires off an http GET request.
- And they can block the UI if not handled right
- HTTP requests are expensive to manage
  - Create a socket
  - Handshakes
  - Reserve memory
  - Clean up file handles
- Bundling puts all JavaScript files into one great big one.



Minify

- Makes your JS smaller by removing every character it doesn't absolutely need.
- webpack - Very capable and does more for you.
- Uglify - Once was very popular
- Browserify - Conceptually easier



Automating the build

- This is a lot of steps! Thank God we don't have to do it manually!
- gulp - Streams - code over configuration
- grunt - Files - configuration over code
- npm run

Package managers

- Download and install components in a controlled, easy way
- Like system package managers but for JavaScript
    - bower - Good for static assets. Has been called "abandonware"
    - npm - Most popular
    - yarn - More efficient

npm

npm does several things

1. Holds project metadata
2. Manages packages (aka libraries)
3. Runs tasks

```
{
  "name": "demo",
  "version": "10.2.4",
  "private": true,
  "dependencies": {
  },
  "scripts": {
  },
  "devDependencies": {
  }
}
```

npm uses package.json as its config file

npm as a package manager

```
{
"dependencies": {
    "bootstrap": "^4.1.2",
    "react": "^16.4.1",
    "react-dom": "^16.4.1",
    "react-scripts": "1.1.4"
  },
"devDependencies": {
    "eslint": "^5.1.0",
    "react-test": "^16.4.1"
  }
}
```

How package.json manages libraries

npm installs libraries in a controlled way

```
npm install
```

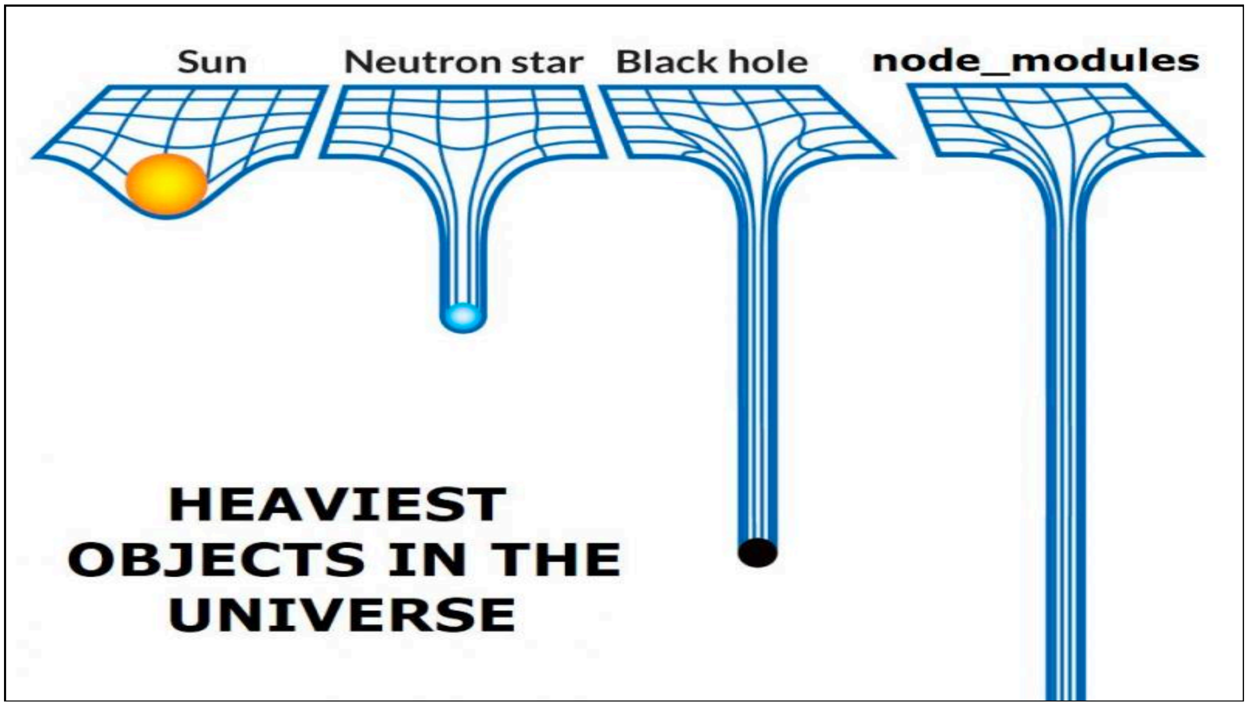
- Reads package.json and installs all the packages in the dependencies and devDependencies

```
npm install packageName
```

- Adds the package to the dependencies section

```
npm install --save-dev packageName
```

- Adds the package to the devDependencies section



npm as task runner

```
"scripts": {
 "test": "jest",
 "e2e": "karma start",
 "build": "eslint && webpack
          && npm run test",
 "server": "node web.js",
},
```

How package.json automates

webpack Introduction

Just touching on this build tool

webpack's main purpose is bundling

But it can do lots of other things ...

- Module loading
- Minification
- Transpiling
- Compressing images
- Copying new files
- Deleting old files
- Running a development server
- And many more!

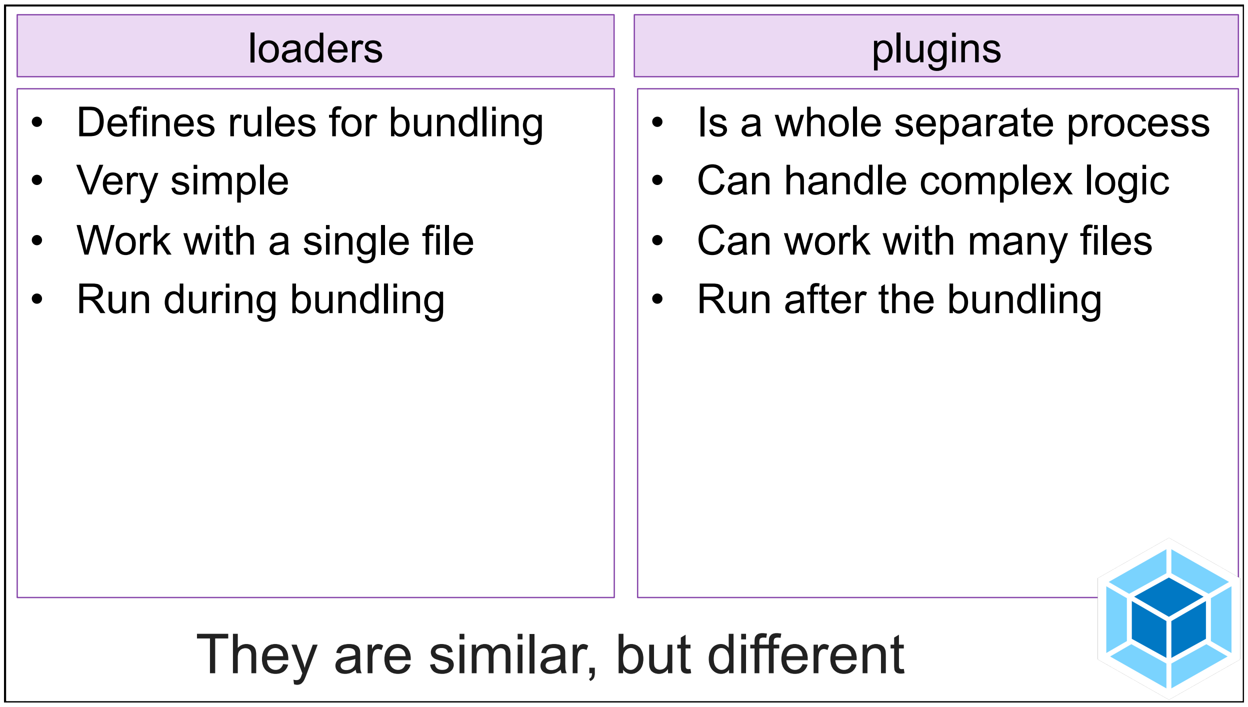
Wait, what is *module loading*?

- webpack will scan your JavaScript files for require/import and export statements. It will then reorder those files so that they are read in the proper order. Eliminates the errors of listing the script files in the wrong order
- It avoids packing those script files which are not needed
- No need to maintain a separate config file with a listing of all scripts needed for particular sections
- The scripts are now self-documenting (in terms of what each requires).
- No need to list the JavaScript files in <script> tags

If webpack baked in all of its capabilities ...

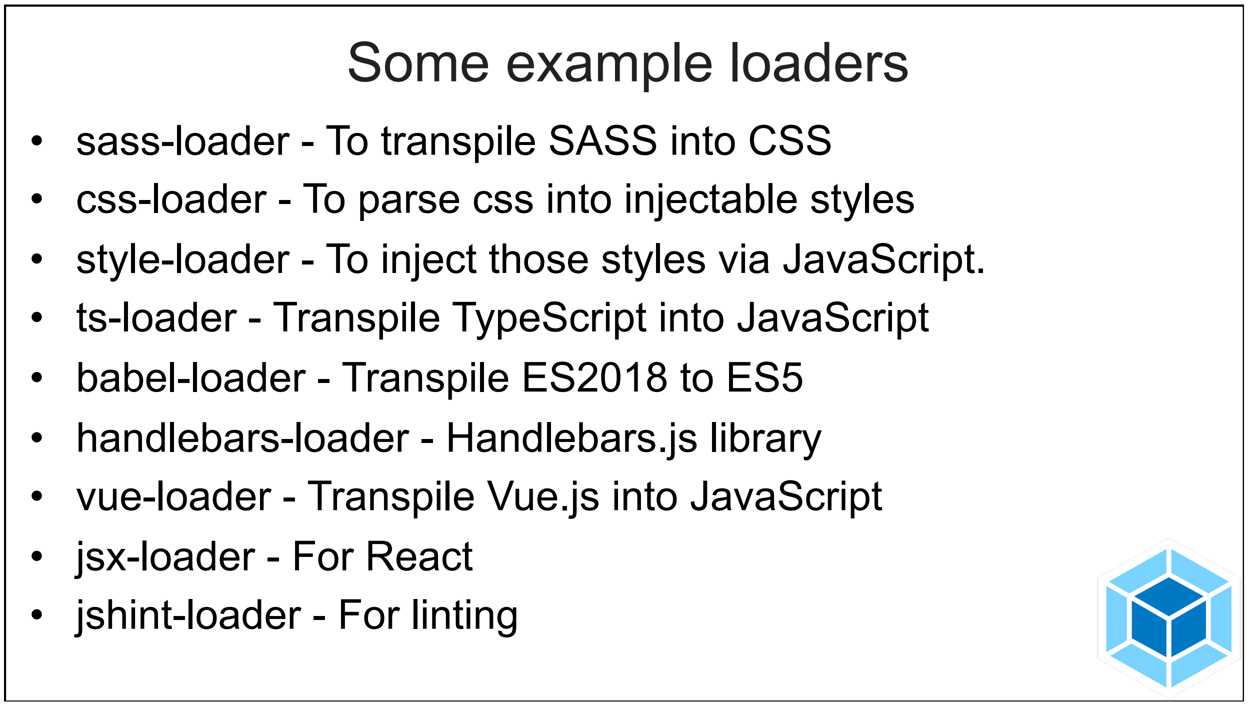
1. It would be huge!
2. It couldn't be extended.

So they separate these capabilities as "plug-ins" and "loaders"



loaders	plugins
• Defines rules for bundling	• Is a whole separate process
• Very simple	• Can handle complex logic
• Work with a single file	• Can work with many files
• Run during bundling	• Run after the bundling

They are similar, but different



Some example loaders

- sass-loader - To transpile SASS into CSS
- css-loader - To parse css into injectable styles
- style-loader - To inject those styles via JavaScript.
- ts-loader - Transpile TypeScript into JavaScript
- babel-loader - Transpile ES2018 to ES5
- handlebars-loader - Handlebars.js library
- vue-loader - Transpile Vue.js into JavaScript
- jsx-loader - For React
- jshint-loader - For linting

Some example plugins

- HTML Plugin - Creation of HTML files
- Copy Plugin - Copies files to another directory
- Bundle Analyzer - Creates a tree map of all files
- Prerender SPA - Creates static pages on the server
- Modules CDN - Can retrieve libraries from a CDN and pack.
- PWA Manifest - Generate a manifest file from contents
- Friendly Errors - Analyzes bundle for common errors
- Dup Package Checker - Tells you if you have a duplicate
- Purge CSS - Tree-shaking for unused CSS rules

webpack.config.js

```
const HTMLPlugin = require('html-webpack-plugin');
module.exports = {
  entry: "./src/index.js",
  output: {
    path: "dist", filename: "scripts/bundle.js"
  },
  module: {
    rules: [
      {test: /\.js$/, u
      {test: /\.css/, u
    ]
  },
  plugins: [
    new HTMLPlugin({template:'./index.html'})
  ]
}
```

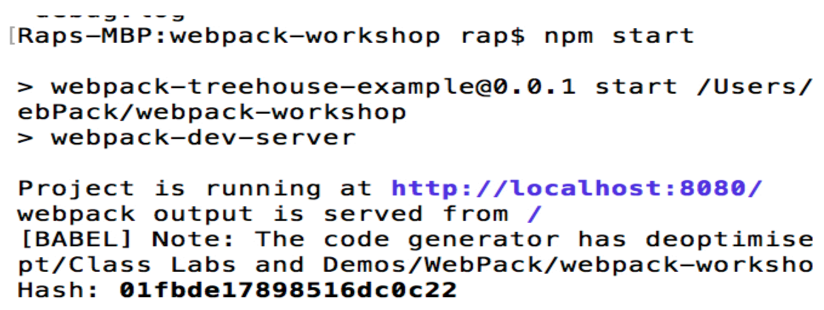
Setup is done in webpack.config.js

webpack.config.js

- entry - What is the topmost JavaScript file?
- output - Where do the bundled file(s) go?
  - path - where to put the built JavaScript
  - file - Name of the .js file
- module - What loaders do we need?
- plugins - What plugins do we need?

Automating using webpack devserver

- For simplifying the dev process. Not for production.
- Will monitor your source files and when one changes,
- Rebuild the app
- Restart the web server



```
Raps-MBP:webpack-workshop rap$ npm start

> webpack-treehouse-example@0.0.1 start /Users/
ebPack/webpack-workshop
> webpack-dev-server

Project is running at http://localhost:8080/
webpack output is served from /
[BABEL] Note: The code generator has deoptimise
pt/Class Labs and Demos/WebPack/webpack-worksho
Hash: 01fbde17898516dc0c22
```

Match the tool to its task

1. npm	A. Static code analyzer
2. webpack	B. Transpiler
3. Babel	C. Minifier
4. node_modules	D. Task runner
5. TypeScript	E. Testing framework
6. esLint	F. Bundler
7. Jasmine	G. None of the above
8. package.json	

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