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Topomat

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Agenda

- **Typescript**
  - What is Typescript?
  - Demo
  - Migration
- **Custom Widgets**
  - About Widgets
  - Demo
  - Migration
- **Tooling**
  - Modules & CDN
  - Webpack

Schedule

09:00 Start

…

…

…

…

…

…

Migrating to Typescript

What is Typescript?

- Superset of JavaScript -> Transpiles to JavaScript
- Compatible with existing JS
- ESNext features (import, =>, res/spread, async/await, …)
- Types

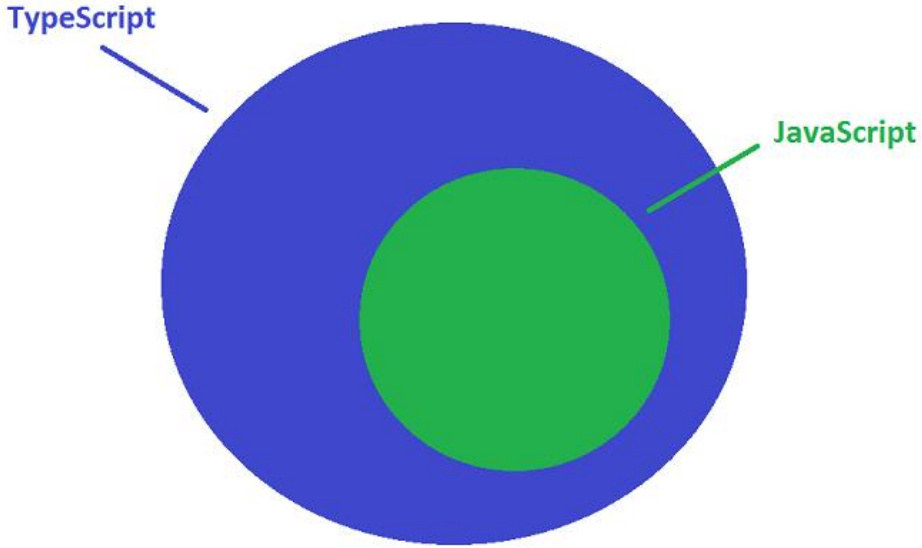


*figure not drawn to scale

Why should you use TypeScript?

- Easier for multiple people to work on
- Easier to refactor
- Can helpt prevent technical debt
- …

Benefits of TypeScript

Primitive (Basic) Types

```
type Foo = number;

const foo: Foo = 8;
const bar: string = "Lorem ipsum";

// Here be dragons
const waldo: any = {
  doStuff: (things: any) => something
};
```

Benefits of TypeScript

Type Inference

```
let foo = 8; // number type is inferred

foo = 12; // Ok

foo = "12"; // Error!
```

Benefits of TypeScript

Define contracts between parts of an application

```
type Foo = number;
type Bar = string;

interface Foobar {
  foo: Foo,
  bar: Bar
}

const baz: Foobar = { foo: 8, bar: "Lorem ipsum" }; // Ok
const qux: Foobar = { foo: "12", bar: "Lorem ipsum" } // Error!
```

Benefits of TypeScript

Classes

```
class Waldo {
  public doStuff(things: Foobar): Foobar { ... }

  private iterateNumber(num: number) {
    return num + 1;
  }

  private addExclamationPoint(str: string) {
    return `${str}!`;
  }
}

const testWaldo = new Waldo(); // Create a Waldo instance
testWaldo.iterateNumber(2); // Error!
```

Benefits of TypeScript

Extensions

- Interfaces can extend other interfaces or classes
- Classes can extend other classes and implement interfaces

```
interface Point {
  x: number;
  y: number;
}

interface Point3d extends Point { z: number; }

class MyPoint implements Point3d {
  x = 0;
  y = 0;
  z = 0;
}

class My4dPoint extends MyPoint {
  time = Date.now();
}
```

Benefits of TypeScript

Union types

- **Type something as one of multiple choices of a type**

```
// Set a size as either a number, of a string like "1px",
// "2em" etc
function setSize(v: number | string) {
  // ...
}
```

Benefits of TypeScript

Type guards

- Type guards allow TS to infer a specific type when a value may take multiple types (union)
- Types are narrowed to a more specific set by type guards
- Built in type guards like typeof, instanceof or tagged unions

```
function foo(v: number | string) {
  if (typeof v === "number") {
    // TS infers that v: number
    return v + 1;
  }
  else {
    // TS infers that v: string
    return `${v} + 1`;
  }
}
```

Benefits of TypeScript

Generics

- **"Generalizes" types over type parameters**

```
class List<T> {
  constructor(private data?: T[]) {
  }

  find(f: (item: T) => boolean): T {
    // ...
  }
}

// Fails
const list = new List<number>(["1", "2"]);

// OK
const list = new List<number>([1, 2]);

// TS infers v to be of type number
list.find(v => v > 1);
```

Benefits of TypeScript

Promises & Async/Await

- "Generalizes" types over type parameters

promises

```
function demoTheater() {
  getQuestion()
    .then(function question() {
      console.log(question);
      return "answer";
    })
}

demoTheater();
```

async / await

```
async function demoTheater() {
  console.log(await getQuestion());
  return "answer";
}

demoTheater();
```

Some Ressources

- https://www.typescriptlang.org/
- https://developers.arcgis.com/javascript/latest/typescript-setup/
- https://odoe.github.io/ds2021-slides/using-typescript/index.html

Typescript demo

1. **Install Typescript**

   ```
   npm install typescript
   ```

2. **Init a new project (tsconfig.json)**

   ```
   npx tsc –init
   ```

3. **Run Compiler**

   ```
   npx tsc --watch -p .
   ```

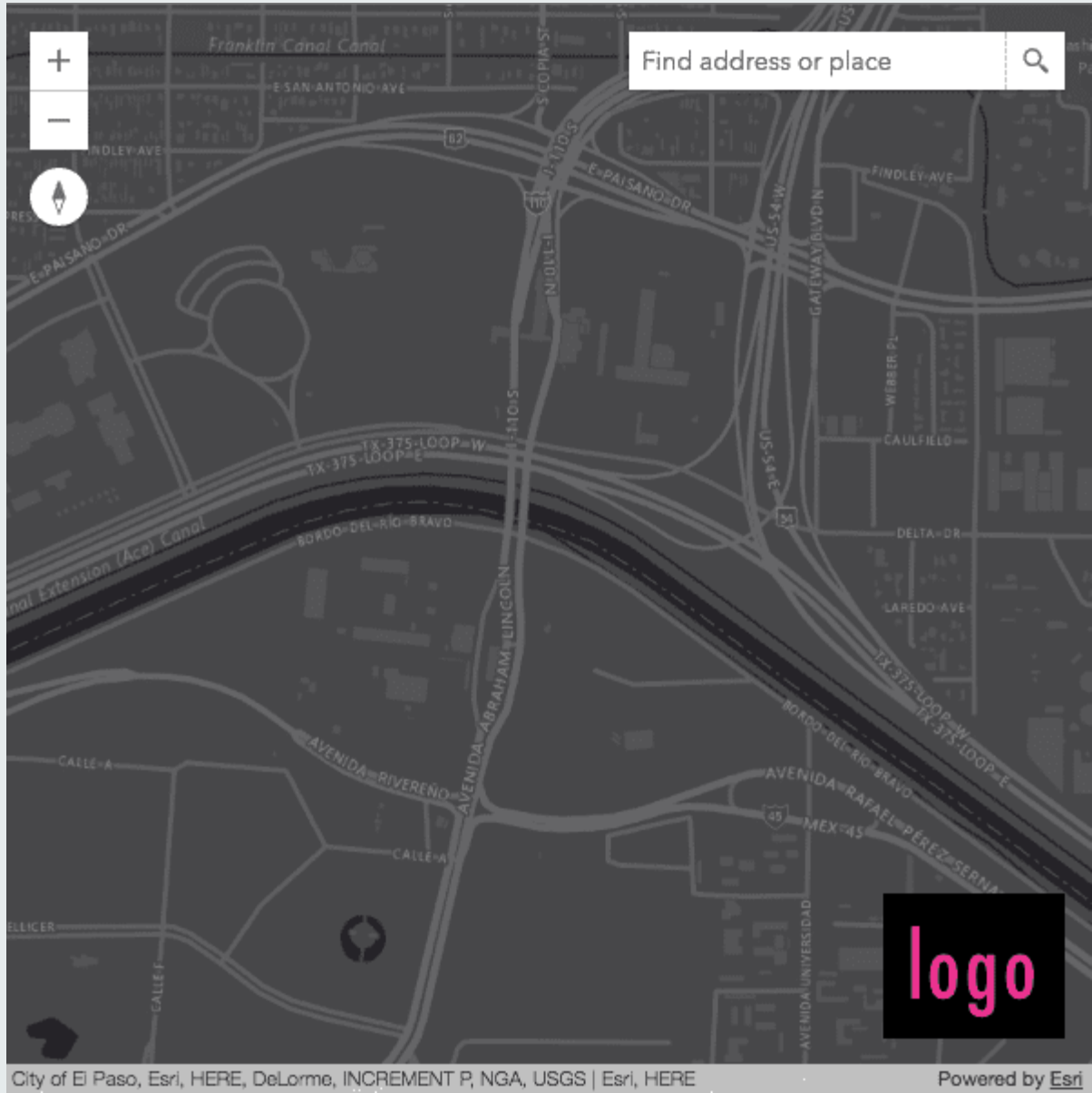
Migrate Sample Application

Custom Widgets

Good to Know: View UI

- **A View provides an API for placing Widgets and DOM elements**

```
view.ui.add(search, "top-right");
view.ui.add(logo, "bottom-right");
```



About Widgets

What?

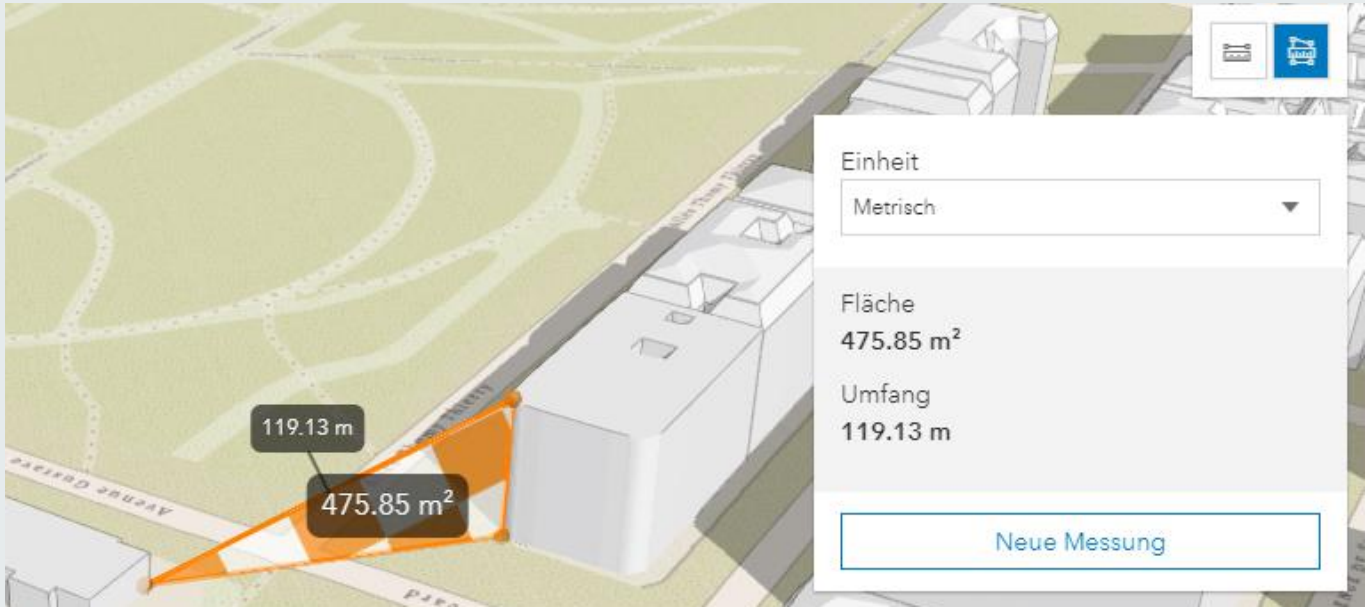
- Encapsulated UI components
- Cohesive (integrated, unified)
- Single-purpose pieces of functionality

Why?

- Reusable
- Interchangable

How?

- Extend `esri/Widgets/Widget`



esri/widgets/Widget

- Base widget class (View)
- Extends esri/core/Accessor
  - Properties
  - Watching properties
- Lifecycle

Accessor

- JavaScript API foundation
- Aims to make developing classes easy
  - Getter/Setter
  - Watch
- Consistent developer experience

```
// unified object constructor
const me = new Person({ name: "Franco", age: 33 });

// watch for changes to `age`
me.watch("age", singHappyBirthday);
```

Lifecycle

constructor (params)

- Widget initially created
- Get, Set and watch properties

postInitialize()

- Before UI is rendered

render() (Required)

- Used to render UI
- Returns the Widgets Markup
- Reacts to state Changes
- Uses JSX (VDOM)

destroy()

- Release the widgets instance

Demo

1. Setup (optional)
2. Create a custom class - Extend the Accessor
3. Create a Widget – View only
4. Creat a Widget – Using a ViewModel

Migrate Widgets

Tooling

Getting the API

- **The API can be accessed as:**
  - **AMD Modules via CDN (our demos before)**
  - **AMD via npm**
  - **ES modules via npm**
  - **ES modules via CDN (we won’t have a look at this)**

AMD via CDN

- **Fast download and highly optimized caching for the API modules**
- **No installation or configuration**
- **Easy to update applications to the next API version**

```
<link rel="stylesheet" href="https://js.arcgis.com/4.18/esri/css/main.css">
<script src="https://js.arcgis.com/4.18/"></script>
```

AMD via npm (Local Build or esri-loader)

- **If version 4.17 or earlier of the API with most frameworks and build tools.**
- **Works with Dojo 1 and RequireJS.**

Disadvantages:

- Requires helper libraries such as esri-loader and arcgis-webpack-plugin when working with modern frameworks and build tools.
- Modules loaded with esri-loader are not bundled with the build, they are requested from the CDN at runtime.
- The arcgis-webpack-plugin needs to be configured and it may require additional libraries to extend webpack, for example when using Angular 9+.

```
npm install esri-loader

npm install arcgis-js-api

npm install @arcgis/webpack-plugin
```

ES modules via npm

- **Standardized**
- **No helper or module loader required**
- **Seamless integration with most modern frameworks**
- **Provides server-side capabilities for node.js deployments, for example, geometry engine**

Disadvantages:

- Updates require installing a new version.

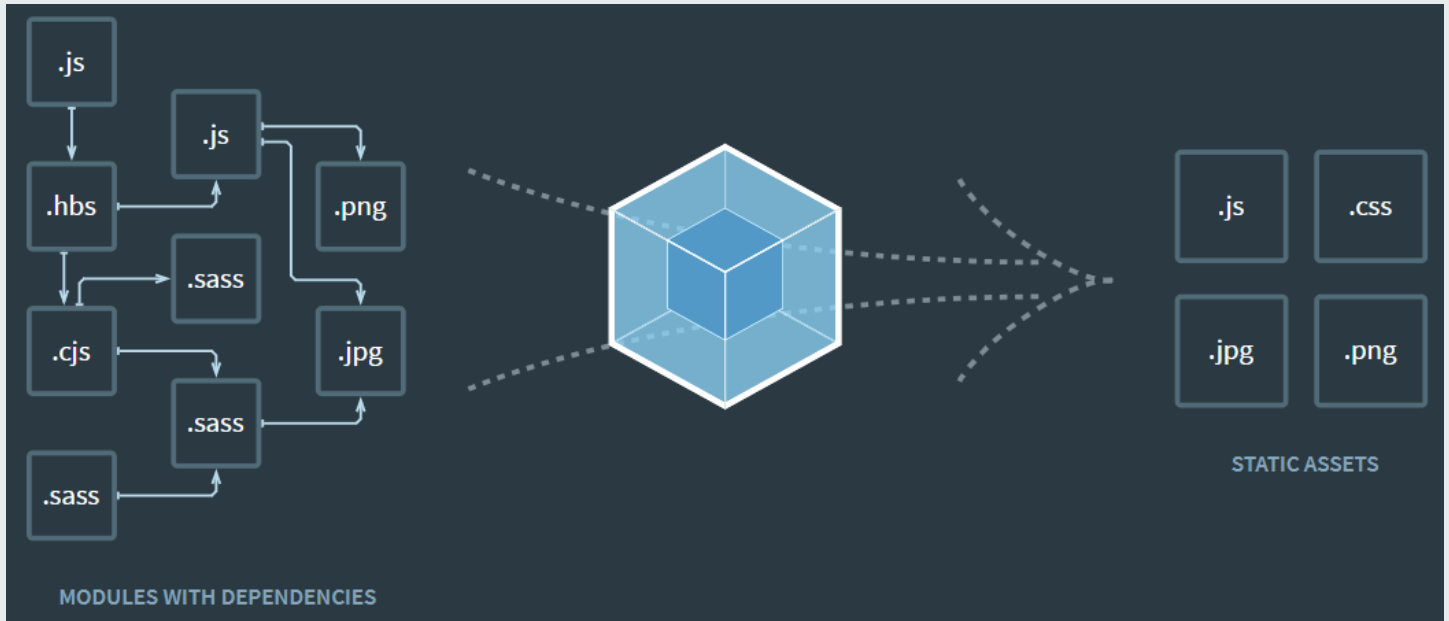
Comparison

	CDN (AMD)	ESM local build	AMD local build
No installation, configuration or local build required	X		
Fast download performance via CDN cache	X		
Easy installation via npm		X	(X)
Seamless integration with most modern frameworks and build tools		X	
Using API version 4.17 or earlier with a framework or build tools			X
Using Dojo 1 or RequireJS			X

Webpack

What is it?

- **Static module bundler**
- **Creates an internal dependency graph**
- **Open source**
- **Extendable**
- **Sometimes a bit tricky to use ;-)**



Source: https://webpack.js.org/

Entry

- **Defines where webpack should begin – Your «first» or «main» module**
- **Can be more than one (e.g. TS and SASS)**
- **Docs**

```
entry: {
  index: ["./src/css/main.scss","./src/index.ts"]
},
```

Output

- **Tell webpack where to emit the output to**
  - **Usually ./dist**
- **Docs**

```
output: {
  filename: "[name].[chunkhash].js",
  publicPath: "",
},
```

Loaders

- **Loaders enable webpack to load any types of files**
  - **By default, webpack only supports JS and JSON files**
- **This gives us a lot of flexibility, because we can use webpack to handle most of our ressources**
- **Docs**

```
module: {
  noParse: /assets\/libs\/widgets/,
  rules: [
    {
      test: /\.html$/i,
      loader: 'raw-loader',
      options: {
        esModule: false
      }
    },
    {
      test: /\.tsx?$/,
      use: [{
        loader: "ts-loader",
        options: {
          transpileOnly: true
        }
      }]
    }
  ]
}
```

Plugins

- Extend the functionality of webpack (cleanup, copy assets, …)
- Need to be loaded seperately
- @arcgis/webpack-plugin ;-)
- Docs

```
plugins: [
  new CleanWebpackPlugin({
    cleanAfterEveryBuildPatterns: ['dist']
  }),

  new ArcGISPlugin({
    locales: ['de', 'fr', 'en']
  })
]
```

Mode

- Enable/disable built in optimization
  - Production build
  - Development mode
- Can be passed as command line param

```
mode: 'production',
```

Webpack and CDN

Demo

- Turn the sample application with the migrated widgets into a webpack app
- Include the „old“ widgets as static library
  - Write some definition files for them

Webpack and Sass

Demo

- Include Sass into your webpack project
- Control which styles are imported from the JS API

Local Builds

Demo

- **Create a webpack application which includes the AMD version of the JS API**

Building apps with ES Modules

Rapid Prototyping

Sample (Not for production)

```
import ArcGISMap from "https://js.arcgis.com/4.18/@arcgis/core/Map.js";
import MapView from "https://js.arcgis.com/4.18/@arcgis/core/views/MapView.js";

const map = new ArcGISMap({
  basemap: 'topo-vector'
});

const view = new MapView({
  container: 'viewDiv',
  map,
  zoom: 4,
  center: [-118, 34]
});
```

Create a local build

Assets

- The API comes with a lot assets, which need to be included in the final product. Use the @arcgis/webpack-plugin or use a tool like ncp (cross-platform copy tool)

```
"scripts": {
    "start": "npm run copy && webpack serve --open --mode development",
    "build": "npm run copy && webpack --mode production",
    "copy": "npx ncp ./node_modules/@arcgis/core/assets ./src/assets"
  },
```

Migrate from ArcGIS Webpack to ES Modules

1. Instead of ‘arcgis-js-api’ install ‘@arcgis/core’ npm package
2. Change your imports from:

```
import Map from 'esri/Map';
import MapView from 'esri/views/MapView';
```

To:

```
// ES modules
import Map from '@arcgis/core/Map';
import MapView from '@arcgis/core/views/MapView';
```

3. Make sure the assets get copied
4. Don’t forget to tweak your tsconfig.json ;-)

Demo

- **Try to migrate the App created in 07_webpack_local_build to ES modules**

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