Esri Developer Summit

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Building Your own Widget with ArcGIS API for JavaScript

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Agenda

- Widgets
- Best practices
- Building our widget
  - 3.x
  - 4.x
- Testing

Widgets

- What?
  - Encapsulated
  - Cohesive
  - Single-purpose pieces of functionality
- Why?
  - Reusable
  - Interchangeable
- How?
  - Different frameworks are available

Dojo Toolkit

- Foundation of ArcGIS JavaScript API
- AMD support
- Class-based inheritance
- Internationalization

Asynchronous Module Definition (AMD)

- Asynchronous loading
- Web-based solution
- Lazy loading
- Fewer globals
- Dependency handling

Asynchronous Module Definition (AMD)

- define

```
// moduleA.js
define(["moduleB"], function (moduleB) {
  // module API
  return {
    _data: 100,
    calculate: function () {
      moduleB.calculate(this._data);
    }
  };
});
```

- require

```
// main.js
require(["moduleA"], function (moduleA) {
  moduleA.calculate();
});
```

dijit/_WidgetBase

what you get

- Lifecycle
  - `constructor`
  - `postMixInProperties`
  - `buildRendering`
  - `postCreate`
  - `startup`
  - `destroy`
- Events
- Getters/Setters
- Property watching

Simple widget example

```
// MyWidget.js
define([
  "dijit/_WidgetBase",
  // ...
],
function(
  _WidgetBase,
  // ...
) {
  return  _WidgetBase.createSubclass({
    // widget magic here! °+✧`(⁰▽⁰)´✧+°
  });
});
```

Simple widget

Code Organization

Keep code modular and organized

Splitting it up (HTML)

- Extract HTML to separate file
- Mix in `dijit/_TemplatedMixin`
  - Renders HTML based on a template string
  - Create DOM node attachments

Splitting it up (HTML) Example

```
<!-- ./templates/MyWidget.html -->
<div>
  <label>°+✧｀(⁰▽⁰)´✧+°</label>
</div>
```

```
// ./MyWidget.js
define([
  "dijit/_WidgetBase",
  "dijit/_TemplatedMixin",
  "dojo/text!./templates/MyWidget.html"
],
function (
  _WidgetBase, _TemplatedMixin,
  template
) {

  return _WidgetBase.createSubclass([_TemplatedMixin], {

    templateString: template,

    // widget magic here! °+✧｀(⁰▽⁰)´✧+°

  });
```

```
});
```

Splitting it up (CSS)

- Extract widget-specific styles to separate stylesheet
- @import widget stylesheet wherever applicable

Best practices – Accessibility (a11y)

- Enable your application to be used by everyone
- Use semantic markup
- ARIA roles
- Consider other input devices besides the mouse
  - Keyboard
  - Touch
  - Screen reader

Best practices – Internationalization (i18n)

- Keep text separate from application logic
- Support multiple languages
- Helps ease translation

```
define({
  root: ({
    "button": "Home",
    "title": "Default extent"
  }),
  "ar": 1,
  ...
  "zh-cn": 1
});
```

Best practices – DOM Manipulation

Here to help...

- `dojo/dom`
- `dojo/dom-attr`
- `dojo/dom-class`
- `dojo/dom-construct`
- `dojo/dom-style` (used sparingly)

Best practices – Styling

Use CSS classes

```
<style>
  .awesome-block {
    background-color: chartreuse;
  }
</style>

<div class="awesome-block"></div>
```

and not inline styles

```
<div style="background-color: chartreuse"></div>
```

Best practices – Styling

Mind specificity

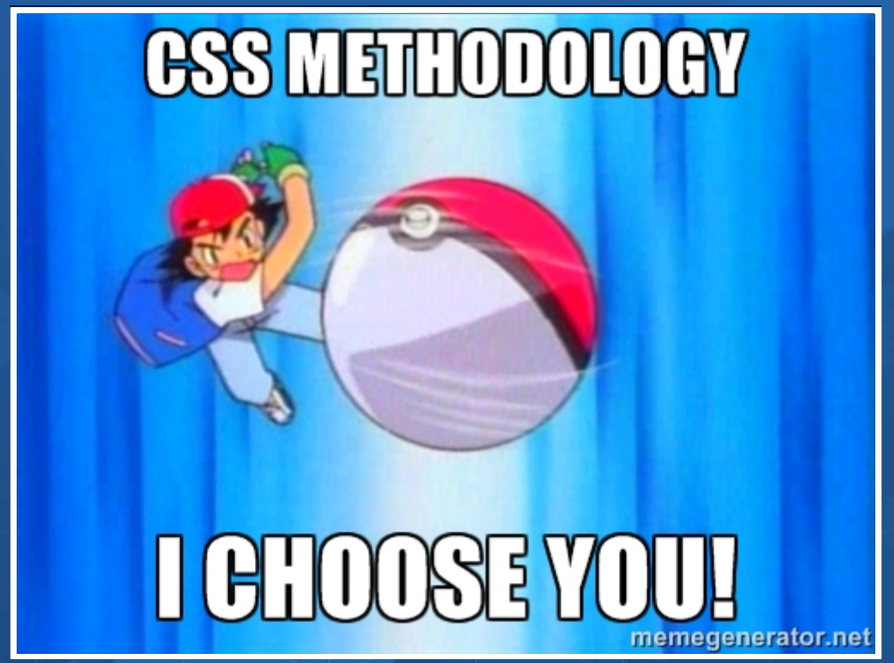
```
<style>
  #red { background-color: red; }  /* ID */

  .blue { background-color: blue; }  /* class */
  .green { background-color: green; }  /* class */

  .blue.green { background-color: yellow; }  /* 2 classes */
</style>

<div id="red"
    class="square green blue"
    style="background-color: orange"></div>
```

- Result
- Specificity calculator

Best practices – Styling

CSS Methodologies

- Establish guidelines/rules for maintainable CSS
  - CSS & HTML best practices
  - Naming conventions
  - Ordering/grouping of CSS rules
- No silver bullet - choose what's best for your project/team
- Flavors
  - Block-Element-Modifier (BEM)
  - Scalable and Modular Architecture for CSS (SMACSS)
  - Object Oriented CSS (OOCSS)
  - SUIT CSS
  - Atomic OOBEMITSCSS
  - ETC LOL...


CSS METHODOLOGY
I CHOOSE YOU!
memegenerator.net

Best practices – Styling

BEM

- Uses delimiters to separate block, element, modifiers
- Provides semantics (albeit verbose)
- Keeps specificity low
- Scopes styles to blocks

```
/* block */
.example-widget {}

/* block__element */
.example-widget__input {}
.example-widget__submit {}

/* block--modifier */
.example-widget--loading {}

/* block__element--modifier */
.example-widget__submit--disabled {}
```

Best practices – Styling

Preprocessors

- Benefits
  - Variables
  - Mixins
  - @import & @extend
- Allow us to
  - Restyle
  - Theme
  - Write less code
- Flavors
  - Sass
  - Stylus
  - Less

WikiWidget (requirements)

- Use Wikipedia API to geosearch for entries
- Display results in a list
- List items should center on the map and display a popup
- The popup should have a link for more info (wiki page)
- Use Sass to compile stylesheets
- Apply BEM

Building WikiWidget

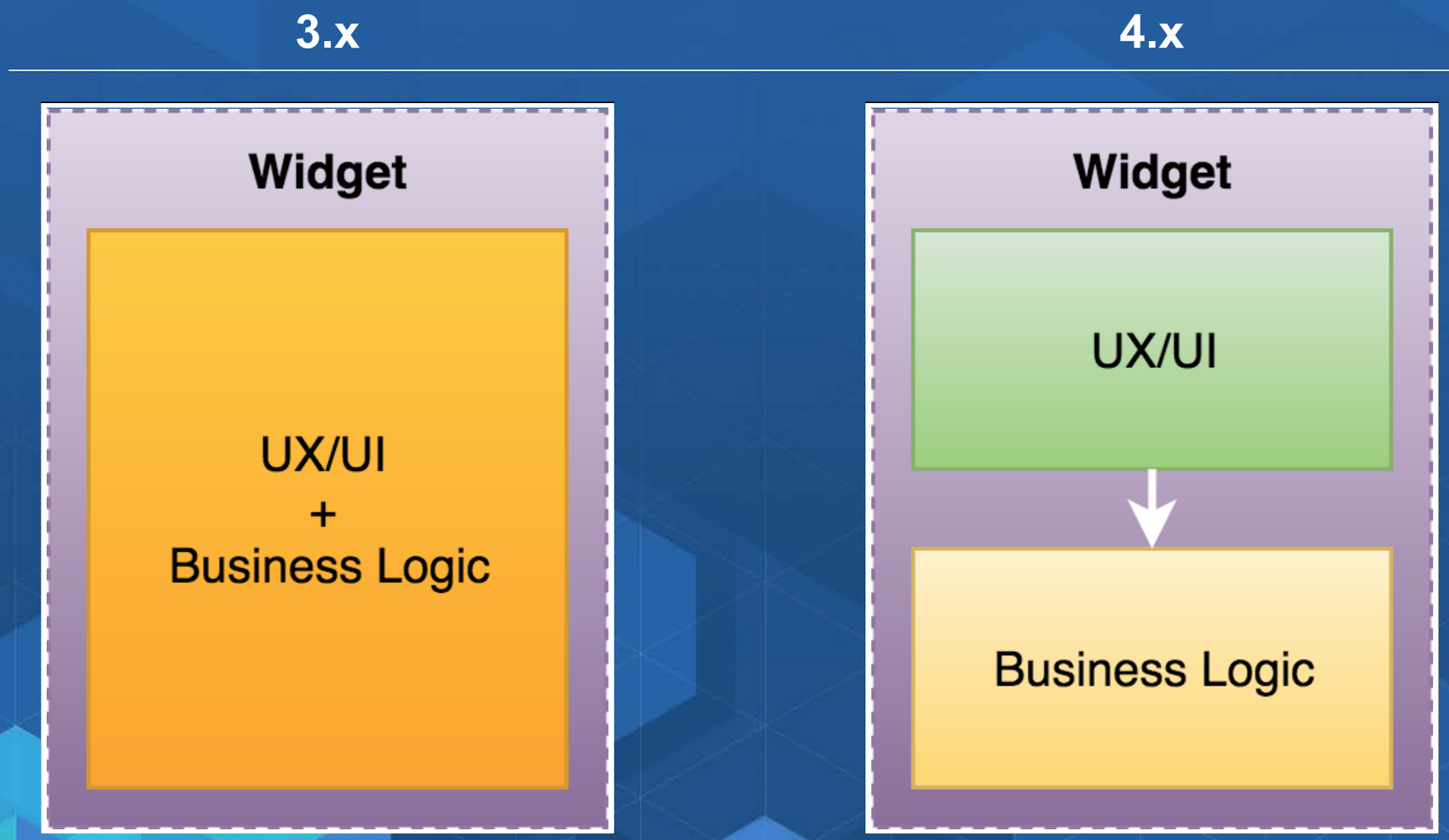
Building WikiWidget the 3x way

demo

Future (4.x)

- Widget Architecture
  - View – the face
  - ViewModel – the brain
- Reusable/Testable core widget logic sans UI concerns
- Framework compatibility
- Separates concerns

Comparison


3.x
4.x
Widget
UX/UI
+
Business Logic
Widget
UX/UI
Business Logic

View

- Uses ViewModel APIs to render the UI
- View-specific logic resides here

ViewModel

- Core logic of widget resides here
- Provides necessary APIs for the view to do it's thing
- No DOM/UI concerns (think data)

Widget SDK

Example: BasemapToggle

ViewModel + frameworks

- Angular 2 – demo
- React – demo
- Elm – demo
- Ember

WikiWidget 4.x

demo

Testing

- Why?
  - Make sure your code works
  - Safety net
  - Investment
  - Code reference

Testing frameworks

- Leverage the power of a framework!
  - Well-established
  - Documented
  - Community
  - Support
  - Automation
- Flavors
  - Intern
  - QUnit
  - Jasmine

Intern

- Flexible
  - Support for different testing interfaces
    - Object (basic)
    - Test-driven development (TDD)
    - Behavior-driven development (BDD)
    - QUnit 1
  - Support for sync and async tests
- Unit & functional tests
- Great documentation
- Node & browser test runners
- Supported modules for testing: AMD, CommonJS, transpiled
- Continuous Integration

Test-writing tips

- Test in isolation
  - mock/stub/spy when needed
    - sinon.js

Test-writing tips

- Strive for readable tests

```
"foo() with invalid value": function(){
    var subject = new Subject();

    var result = subject.foo(null);

    assert.isUndefined(result);
  }
```

Test-writing tips

- Recommended structure for tests

```
"test": function() {
  // setup

  // test

  // assertion
}
```

Test-writing tips

- Single logical assertion per test

```
"result of foo()": function() {
    var subject = new Subject();

    var result = subject.foo({
      items: 5
    });

    assert.instanceOf(result, Result, "is of Result type");
    assert.lengthOf(result.items, 5, "number of items are generated");
    assert.equal(result.title, "", "default title is ''");
  }
```

Test-writing tips

- Make sure tests fail when they're supposed to

```
"someMethod returns 'DevSummit 2016'": function() {
  // ":D" does NOT fail
  assert.ok(util.someMethod());
}
```

```
"someMethod returns 'DevSummit 2016'": function() {
  assert.equal(util.someMethod(), "DevSummit 2016");
}
```

Test-writing tips

- Strive to make tests fail fast

```
"test async method": function() {
    return util.someAsyncMethod({
      delay: 0 // default is 2000ms
    });
  }
```

Recommended sessions

- ArcGIS API for JavaScript: Discover 4.0 the Next Generation
- The Road Ahead: ArcGIS API for JavaScript
- Using and Customizing the ArcGIS API for JavaScript Widgets
- CSS: Rules to Style By
- Accessible Web Mapping Apps: ARIA, WCAG and 508 Compliance
- Modern Tools for the Modern Web Developer
- Optimizing Your JavaScript App for Performance
- Full Stack End to End JavaScript Testing with Intern
- Using TypeScript with ArcGIS JS API Development
- Write Better Code
- Ask a UX & UI Expert

Additional Resources

- Github -> jcfranco -> devsummit 2016 building widgets
- Documentation - 4.0 beta

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Q & A

Questions?