Day 33

Change Detection

- Angular updates components when certain even occurs
  - DOM event fires eg, button clicked, input receiving focus, etc
  - `setTimeout()`, `setInterval()` completes
  - HTTP request completes
  - Variable the is bound to `@Input()` changes
- All attribute bindings are updated, the view is redrawn

```
<app-list [data]="count"></app-list>
```

  - `count` is reassigned to data attribute when change detection occurs
  - view is updated and component gets the latest `count` value
- Use the `OnChanges` to listen to updates to `@Input()`
  - Use case is for performing actions on dependent values eg. calculating the total cost when the shopping cart changes
  - `ngOnChanges` is only triggered if the variable change eg. assigned a new value

Example - ngOnChanges Lifecycle Hook

```
@Component({...})
export class AppCounter implements OnInit, OnChanges {
  @Input()
  data: number = 0
  values: number = []
  total: number = 0

  ngOnInit() {
    this.total += this.data
    this.values.push(this.data)
  }

  ngOnChagnes(changes: SimpleChanges) {
    this.total += this.data
    this.values.push(this.data)
  }
}
```

app.component.html

```
<app-counter [data]="value"></app-counter>
```

app-counter.component.html

```
<ul>
  <li *ngFor="let v of values>{{ v }}</li>
  <li> Total: {{ total }}
```

Update to `value` causes `values` and `total` to be updated

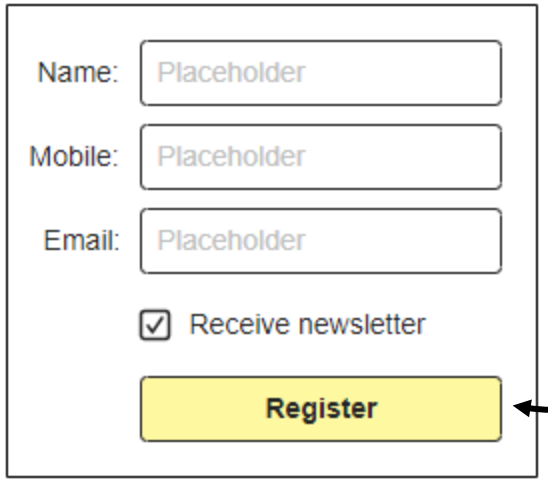
Update the dependents when binding changes

Update the dependents when component is created

Content Projection

- Content projection allows a parent component to project its content into a child component
- Use cases
  - Spinners
  - Additional form controls
- Type of projection
  - Single slot projection
  - Multiple slot project
  - Conditional projection
    - Will not be covering multiple and conditional projection

```
<app-registration>
  <button type="button"(click)="process()">
    Register
  </button>
</app-registration>
```



This is from the parent component

ng-content

app-component.html

```
<app-registration>
 <button type="button"(click)="process()">
  Register
 </button>
</app-registration>
```

app-registration.html

```
<form ...>
  ...
  <ng-content></ng-content>
</form>
```

Content goes here

`@ViewChild`

- A way to allow a parent to access its child
  - Called a view query
  - Can only query immediate children
- Parent get a reference of the child component's instance
  - Manipulate the child component programmatically other than using attribute and event binding
  - Returns null if child is not found within the parent
- Component instance is only available after `AfterViewInit` lifecycle
- Use case: may be used with content projection to access values from a form's controls

Class Selector and Element Selector

Template reference

app-component.html

```
<app-registration #regForm>
  <button type="button" (click)="process()" >
    Register
  </button>
</app-registration>
```

RegistrationComponent class implements this

Query with class

app-component.ts

```
@Component({...})
export class AppComponent
    implements AfterViewInit {
  @ViewChild(RegistrationComponent)
  regForm: RegistrationComponent

  ngAfterViewInit() {

  }
}
```

Query with template reference

app-component.ts

```
@Component({...})
export class AppComponent
    implements AfterViewInit {
  @ViewChild('regForm')
  regForm: RegistrationComponent

  ngAfterViewInit() {

  }
}
```

regForm is only available at `ngAfterViewInit()`

Example - Content Projection and `ViewChild`

```
@Component({...})
export class RegistrationComponent implements OnInit {

  @Input()
  title: string

  get values(): Registration {
    return this.form.value as Registration
  }

  form!: FormGroup
  constructor(private fb: FormBuilder) { }

  ngOnInit() {
    this.form = this.fb.group({...})
  }
}
```

Attribute to add a title to the form

A property to get the form's values

```
<h2>{{ title }}</h2>
<form [formGroup]="form">
  ...
  <ng-content></ng-content>
</form>
```

Content is projected to here

Example - Content Projection and `ViewChild`

```
@Component({...})
export class AppComponent implements AfterViewInit {

  @ViewChild(RegistrationComponent)
  regForm: RegistrationComponent

  ngAfterViewInit() {
    this.regForm.title = "New Product Registration"
  }

  processRegistration() {
    const newReg: Registration = this.regForm.values
    ...
  }
```

Instead of using attribute binding, programmatically set the component attribute. Component is only accessible on `AfterViewInit`

When the button (projected) is pressed, get the values from the component

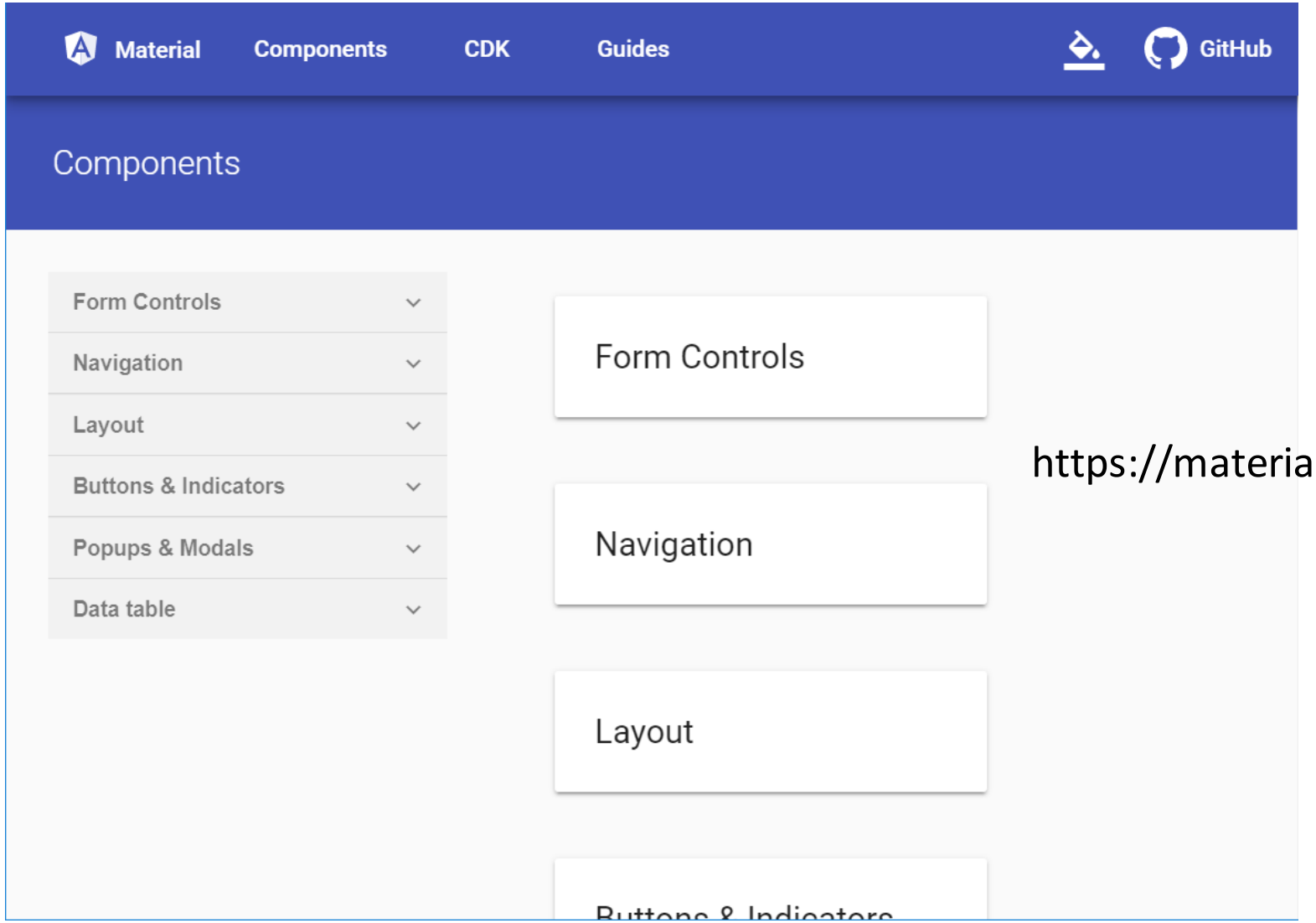
```
<app-registration>
  <button type="button" (click)="processRegistration()">
</app-registration>
```

Angular Material

- Set of UI components for Google's Material Design Specification
- Consist of Component Development Kit and Material components
  - Dependent on animations and hammer.js
- Angular Materials Setup
  - See https://material.angular.io/guide/getting-started for details

```
ng add @angular/material
```

Angular Materials Documentation Page



https://material.angular.io/components/categories

Using Material Components

- Material component consist of one or more material markup
  - Eg `<button mat-button>`, `<mat-icon>`
- Almost every component is in a separate module
  - Need to import module to unlock component
- Example: `mat-button`, `mat-raised-button`, `mat-fab`
  - From `MatButtonModule`

Using Angular Material Components

```
import { MatButtonModule } from '@angular/material/button';
import { MatIconModule } from '@angular/material/icon';
const MATERIAL = [ MatButtonModule, MatIconModule ];
@NgModule({
   imports: MATERIAL,
   exports: MATERIAL
})
export class MaterialModule { }
```

Keep Material module imports in a separate module

```
import { MaterialModule } from './material.module';
@NgModule({
   imports: [ BrowserModule, MaterialModule ],
   ...
})
export class AppModule {
```

Import `MaterialModule` into the `AppModule`

Example - Buttons

Press

```
<button type="button"
     mat-button>
   Press
</button>
```

Press

```
<button type="button"
     mat-raised-button>
   Press
</button>
```

Press

```
<button type="button"
     color="primary"
     mat-raised-button>
   Press
</button>
```

```
<button type="button"
     mat-icon-button>
   <mat-icon>favorite<mat-icon>
</button>
```

```
<button type="button"
     color="accent"
     mat-raised-button
     mat-icon-button>
   <mat-icon>favorite<mat-icon>
</button>
```

Coffee

```
<button type="button"
     color="warn"
     mat-button>
   <mat-icon>
     free_breakfast
   <mat-icon>
</button>
```

Form Field

`mat-form-field` are used to wrap `input` and `textarea`

```
<form [formGroup]="rsvpForm"
   (ngSubmit)="process(form)">

  <mat-form-field>
    <input type="email" formControlName="email"
        placeholder="Please enter your email"
        matInput>
  </mat-form-field>

</form>
```

Please enter your email

Blur

Please enter your email

Focus

Radio Button

Yes No

```
<mat-radio-group formControlName="attending">
  <mat-radio-button value="yes">
    Yes
  </mat-radio-button>
  <mat-radio-button value="no">
    No
  </mat-radio-button>
</mat-radio-group>
```

Select

Guest

```
<mat-form-field>
  <mat-select placeholder="Guest" formControlName="guest" >
    <mat-option *ngFor="let g of [0, 1, 2, 3]"
        [value]="g">
      {{ g }}
    </mat-option>
  </mat-select>
</mat-form-field>
```

Checkbox

☐ Yes, I wish to receive newsletter

```
<mat-checkbox formControlName="newsletter">
  Yes, I wish to receive newsletter
</mat-checkbox>
```

Checkbox - Multiple Values

Diet:

☐ Fish ☐ Meat ☐ Vegetables

```
labels = [ 'Fish', 'Meat', 'Vegetables' ]
dietArray: FormArray
rsvpForm: FormGroup

ngOnInit() {
   this.dietArray = this.fb.array(
      this.labels.map(()=>this.fb.control(''))
   )
   this.rsvpForm = this.fb.group({
      ...
      diet: this.dietArray
   })
}
```

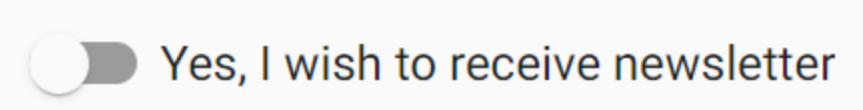
Checkbox - Multiple Values

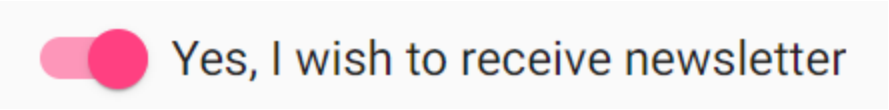
Diet:

☐ Fish ☐ Meat ☐ Vegetables

```
<mat-checkbox [formControl]="diet"
  *ngFor="let died of dietArray.controls; let i = index">

  {{ labels[i] }}

</mat-checkbox>
```

Slide Toggle






```
<mat-slide-toggle formControlName="newsletter">
  Yes, I wish to receive newsletter
</mat-slide-toggle>
```

Date Picker

- Date picker requires a date implementation, supported implementations (https://material.angular.io/components/datepicker/overview#choosing-a-date-implementation-and-date-format-settings)
  - Native
  - date-fns - https://github.com/date-fns/date-fns
  - Luxon - https://moment.github.io/luxon/
- Install an implementation

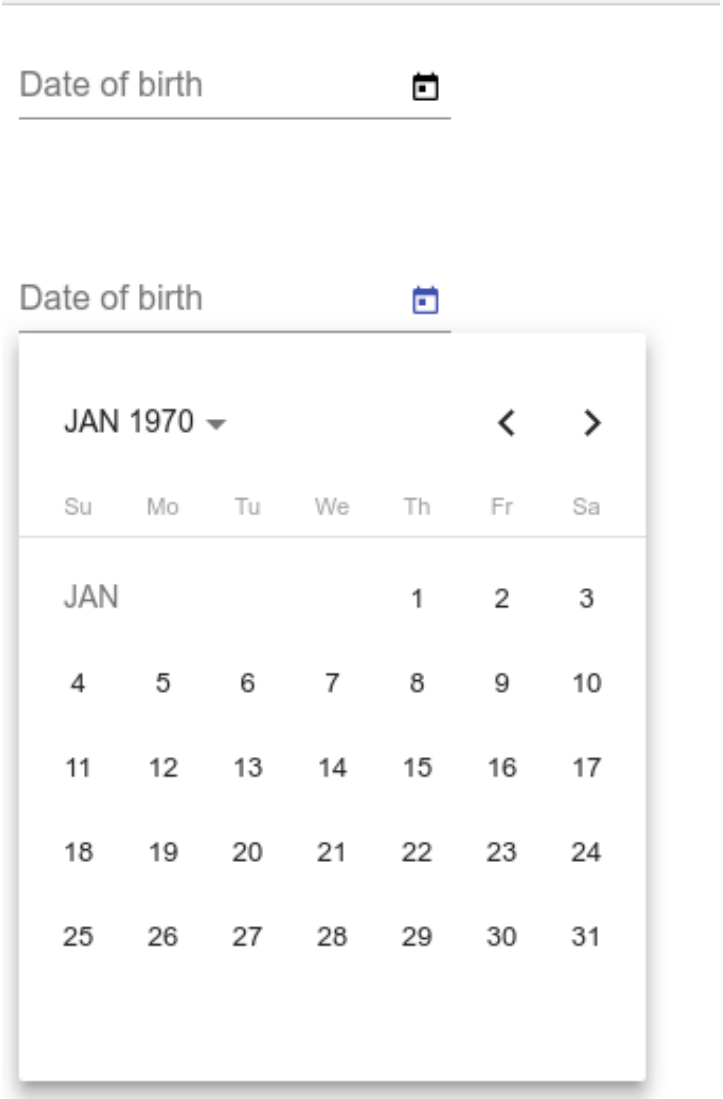
```
npm install --save @angular/material-luxon-adapter
```

- Add to `app.module.ts`

```
import { MatLuxonDateModule }
     from '@angular/material-luxon-adapter';
```

Date Picker

```
<mat-form-field appearance="fill">

  <input matInput
    [matDatepicker]="datepicker"
    placeholder="Date of birth"
    formControlName="dob">

  <mat-datepicker-toggle matSuffix
    [for]="datepicker">
  </mat-datepicker-toggle>

  <mat-datepicker #datepicker>
  </mat-datepicker>

</mat-form-field>
```



Mobile Application

Native

- Access native API
- Cannot run on multiple platform
- Run offline
- Distribute via app store

Web

- Cannot access native API
- Multiple platform support
- Cannot run offline
- Distribute via the web

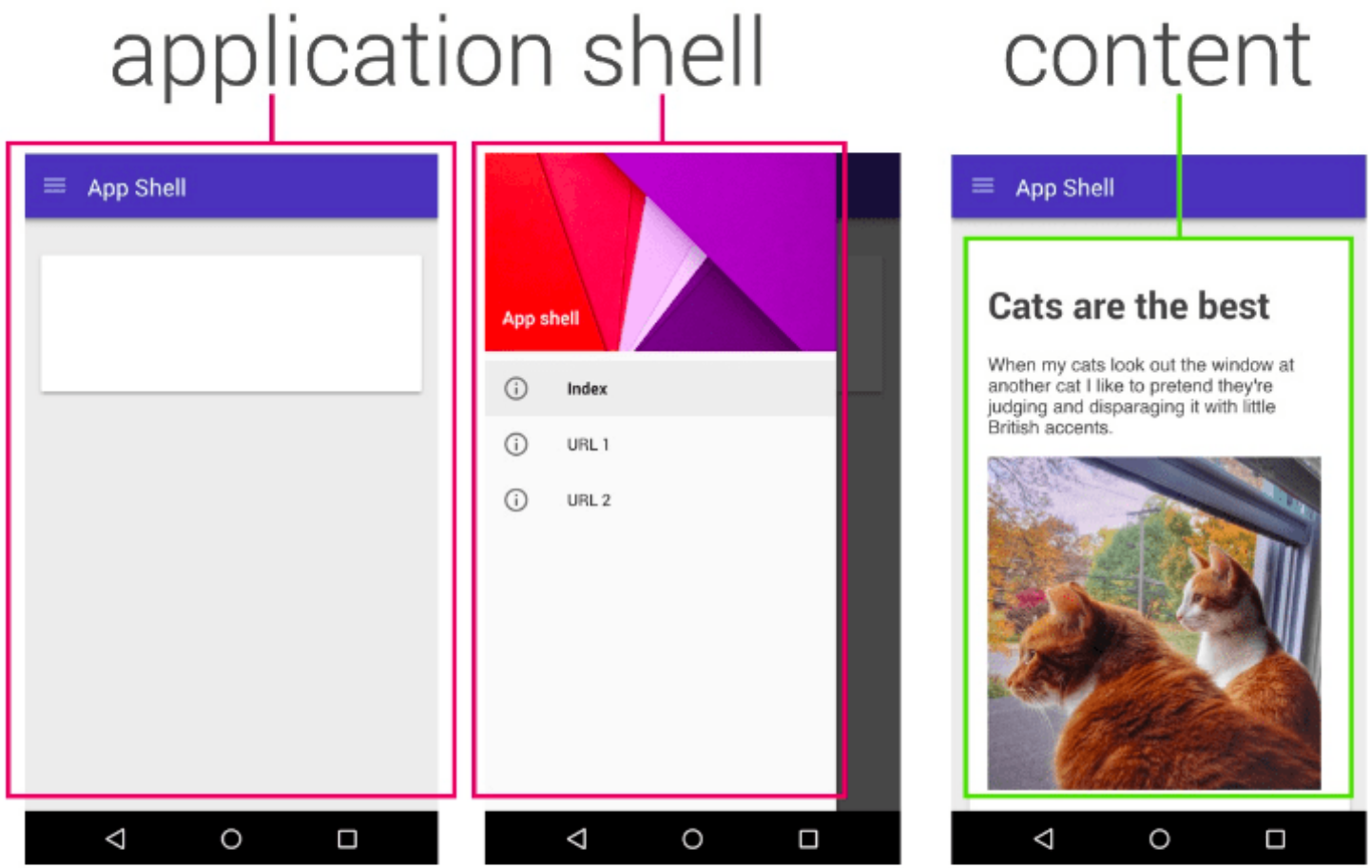
Hybrid

- Can access native API
- Multiple platform support
- Run offline
- Distribute via the web

Progressive

- Limited by the browser
- Multiple platform support
- Run offline
- Distribute via the web

Progressive Web Application



Cached shell loads **instantly** on repeat visits.

Dynamic content then populates the view

Image from https://developers.google.com/web/fundamentals/architecture/app-shell

Progressive Web Application Features

- Install as ‘native’ application on the phone, tablet’s screen
- Has a service worker running in the background of the application
- Service worker
  - Caches the web application, HTML, CSS, JavaScript, images, etc so that the web application can run offline
  - Intercept outgoing or incoming HTTP request; can return previously cached data or modify request or result
- Receive web notifications
  - Web notifications allows backend to push data/notifications to registered web application even if the web application is not opened
  - Eg. WhatsApp web notification

Application Manifest

- A JSON file that provides information about an application
  - Eg. name, icon, splash screen, screen orientation, etc.
- The purpose of the manifest is to allow web application to be installed on a mobile device's home screen
  - If supported
- Is a core building block of PWA
  - Service worker
  - Push notification
  - Offline cache

Application Manifest

- Create a JSON file with one or more of the following properties
  - `name` - application's name
  - `short_name` - for use in space constrained
  - `start_url` - the URL that start/bootstraps the application
  - `scope` - what are the pages to be included with this application; typical value is /
  - `display` - how the application should be displayed. Valid values are
    - `standalone` - no browser control
    - `fullscreen` - similar to standalone
  - `background_color` - RGB
  - `theme_color` - top bar calor RGB
  - `icons` - an array of icons
  - `orientation` - valid values include
    - `landscape`, `portrait`, `any`

Example - manifest.json

```
{
  "name": "My Awesome App",
  "short_name": "AwApp",
  "theme_color": "#2196f3",
  "background_color": "#2196f3",
  "display": "standalone",
  "scope": "/",
  "start_url": "/",
  "icons": [
    {
      "src": "images/icons/icon-72x72.png",
      "sizes": "72x72",
      "type": "image/png"
    },...
  ]
}
```

Application Manifest Generator

https://manifest-gen.netlify.app/

https://www.simicart.com/manifest-generator.html/

Unzip in your application's `src` or `assets` directory depending on how the manifest is generated

```
src
├── app
│   ├── app.component.css
│   ├── app.component.html
│   ├── app.component.spec.ts
│   ├── app.component.ts
│   ├── app.module.ts
│   └── material.module.ts
├── assets
├── environments
│   ├── environment.prod.ts
│   └── environment.ts
├── favicon.ico
├── images
│   └── icons
│       ├── icon-128x128.png
│       ├── icon-144x144.png
│       ├── icon-152x152.png
│       ├── icon-192x192.png
│       ├── icon-384x384.png
│       ├── icon-512x512.png
│       ├── icon-72x72.png
│       └── icon-96x96.png
├── index.html
├── main.ts
├── manifest.json
├── polyfills.ts
├── styles.css
├── test.ts
├── tsconfig.app.json
├── tsconfig.spec.json
└── typings.d.ts
```

Add Application Manifest to Application

- Add `<link>` to `src/index.html`

```
<link rel="manifest" href="/manifest.json">
```

- Include `manifest.json` and `images` directory as part of the build
  - Edit `angular.json`

```
"apps": [
  {
    "assets": [ "src/assets", "src/favico.ico",
      "src/manifest.json", "src/images"
    ],
]
```

Application Identity

- `id` property give the PWA application an identity
- The mobile phone will treat the PWA as a new application even if the PWA has already been installed
- `id` should be the same as `start_url` attribute

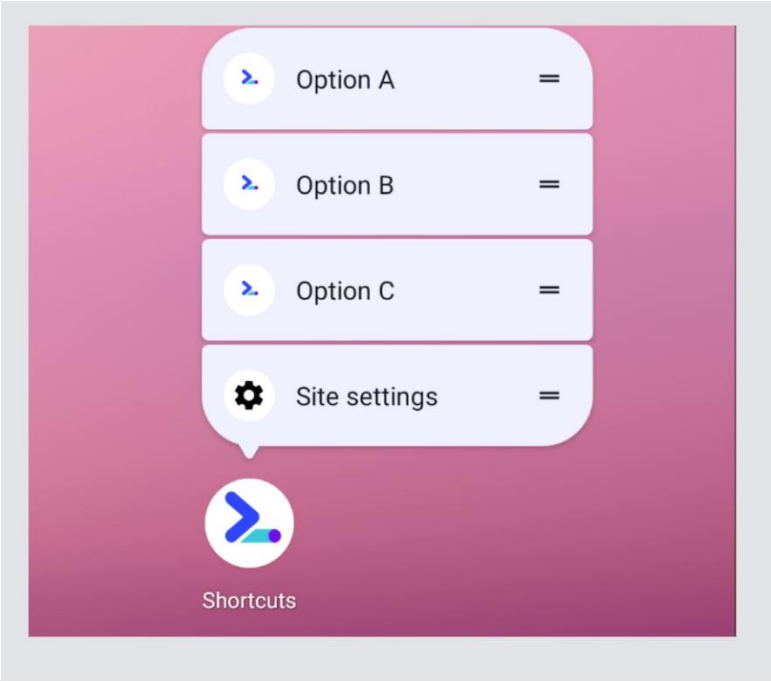
```
"start_url": "/",
"id": "/"
```

Shortcuts

- Short cuts is a static list of deep links into the PWA application

```
{
  "start_url": "http://server.com",
  "shortcuts": [
    {
      "name":  "Option A",
      "short_name": "Option A",
      "description: "...",
      "url": "/option?selection=A",
      "icons": [
        {
          "src": "/icons/icon.png",
          "sizes": "192x192"
        }
      }
      ...
    ]
}
```

A single shortcut entry



The following URL will be fetched with the shortcut is selected

http://server.com/option?selection=A

Image from https://web.dev/learn/pwa/enhancements/

Empty Service Worker

index.html

```
<head>
  <script src="reg_sw.js"></script>
  …
```

sw.js

```
console.info('Idle service worker')
```

Register an empty service worker in the Angular's `index.html` file

reg_sw.js

```
if ('serviceWorker' in navigator) {
  navigator.serviceWorker.register('/sw.js')
    .then(reg => {
      console.info('Service worker registered ', reg)
    })
    .catch(error => {
      console.error('Cannot register server worker ', error)
    })
}
```

Application Manifest Installed

Your email *

Please enter a valid email

Your phone *

Please enter a 8 digit phone number

Register Me

Elements | Console | Sources | Network | Performance | Memory | Application | Security | Augury

Application
- Manifest
- Service Workers
- Clear storage

Storage
- Local Storage
- Session Storage
- IndexedDB
- Web SQL
- Cookies

Cache
- Cache Storage
- Application Cache

Frames
- top

Name: My Awesome App

Short name: AwApp

Presentation

Start URL: /

Theme color: #2196f3

Background color: #2196f3

Orientation:

Display: standalone

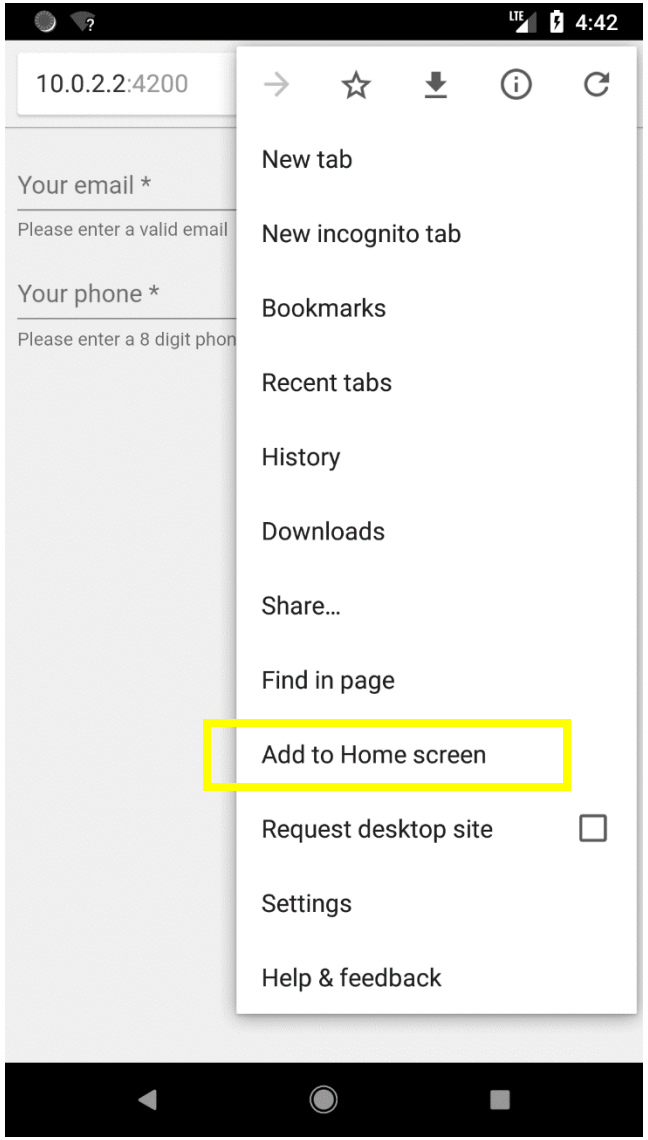
Icons

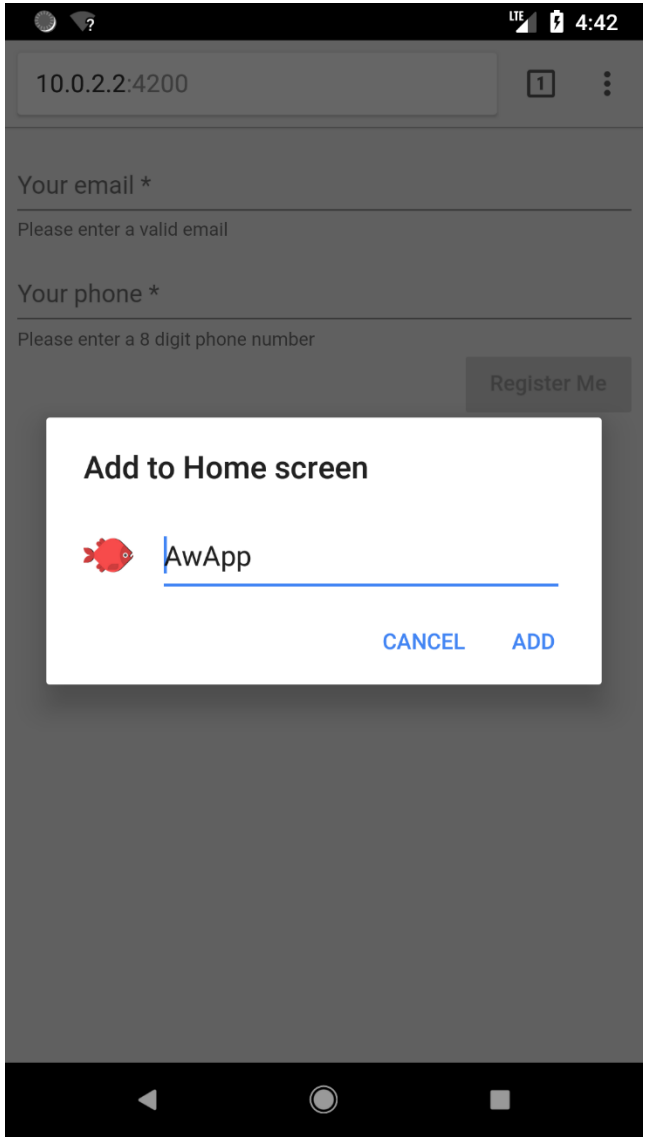
72x72 image/png

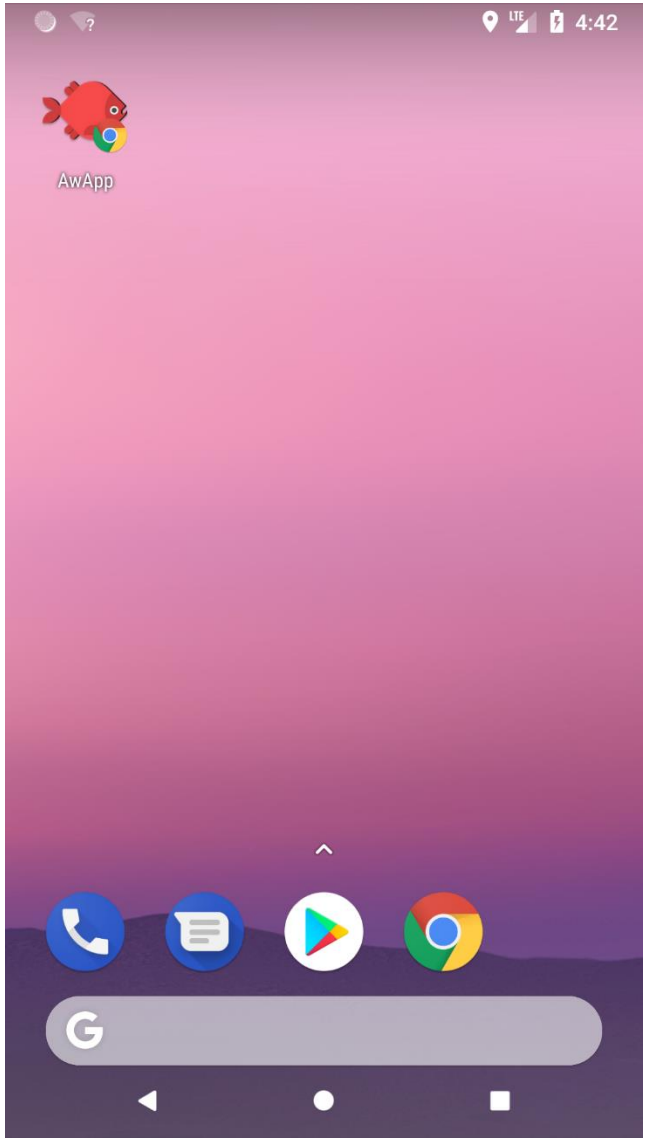
96x96 image/png

128x128 image/png

On Mobile Phone







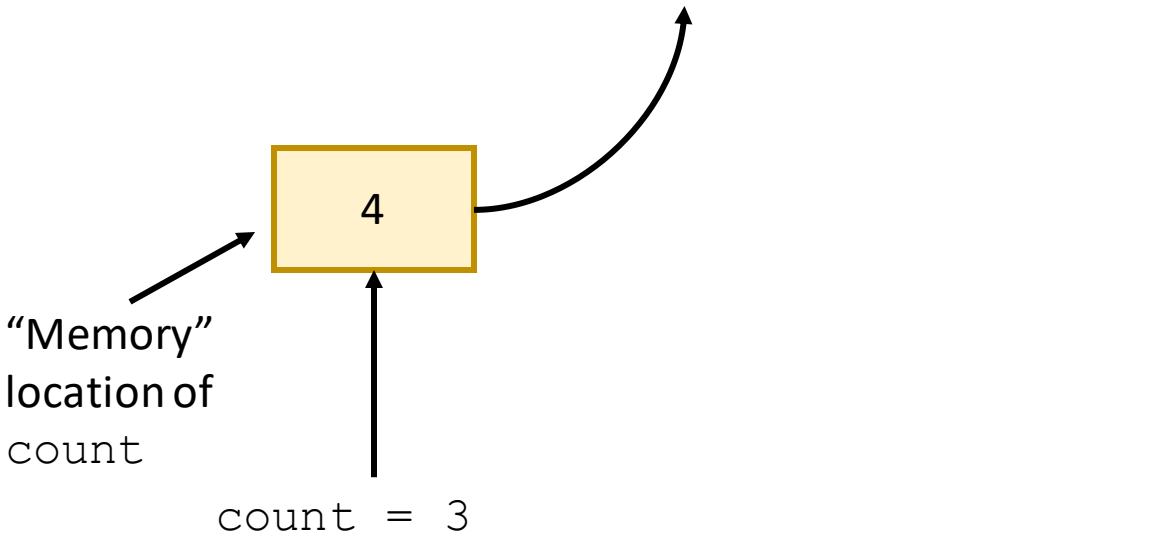
Inspect Android Chrome

- Enable developer mode on Android phone
- Attach phone to notebook/computer
- Allow Android phone to be debugged via USB
- Open Chrome browser on notebook/computer
  - `chrome://inspect/#devices`

Unused

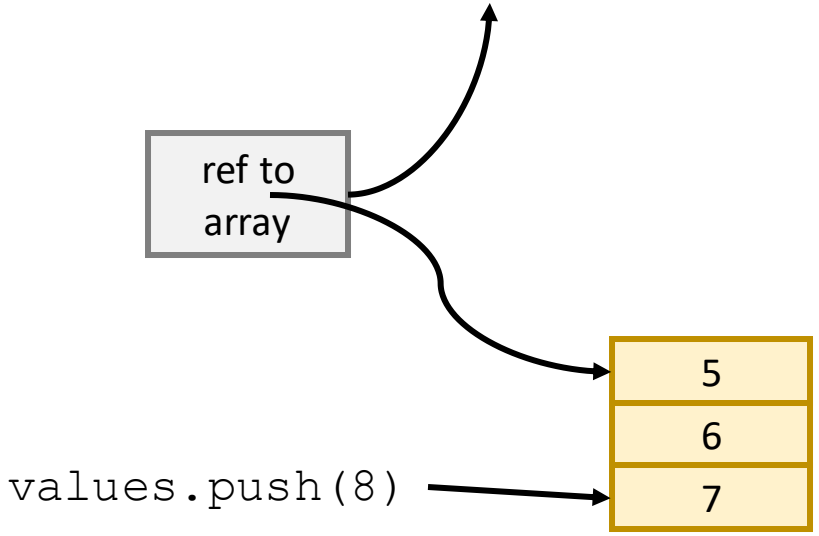
Attribute Binding

```
<app-list [data]="count"></app-list>
```



When `count` is reassigned a new value, change detection occurs: view is updated and the value is pushed to the component

```
<app-list [data]="values"></app-list>
```



When a new element is push to `values`, the array changes but the variable to the array did not change View is update but the new element is not pushed to the component

Typescript Types and Attribute Binding

- Value types
  - number
  - string
  - boolean
  - null, undefined
- Reference types
  - array
  - object
  - function
- Need to reassign a new reference for change detection to occur

app.component.html

```
<app-counter [list]="values"></app-counter>
```

app.component.ts

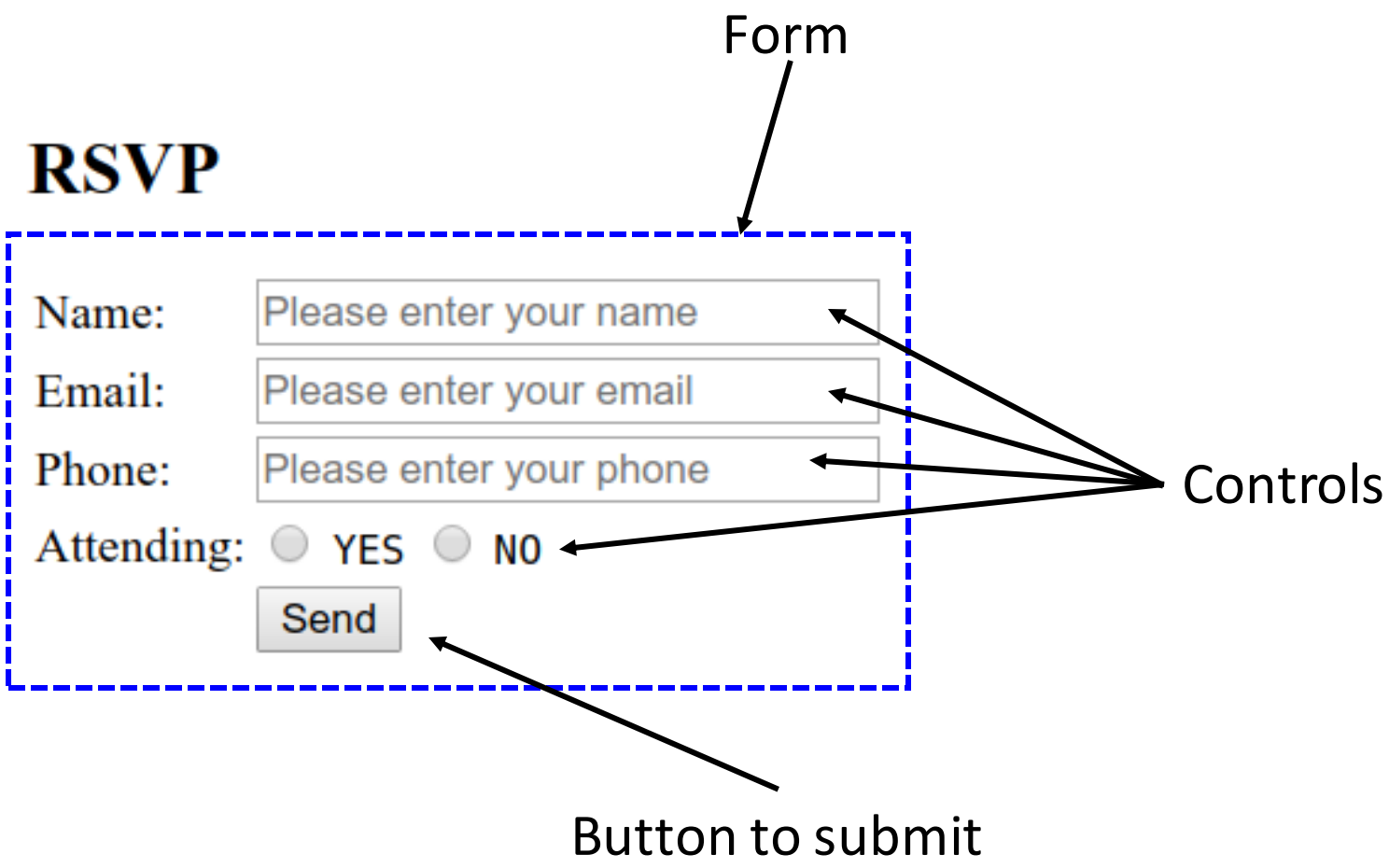
```
@Component({})
export class AppComponent {
  values: number[] = []

  addToList(newValue: number) {
    this.values = [ ...this.values, newValue ]
  }
}
```

Recreating the reference type with the new value

```
this.values.push(newValue)
```

Array with new element will not be pushed to component

Form


Form
RSVP
Name:
Please enter your name
Email:
Please enter your email
Phone:
Please enter your phone
Attending:
YES
NO
Send
Controls
Button to submit

Form

Form

```
<form>

  Name: <input type="text" name="name">

  ...

  Attending:
  <input type="radio" name="attending" value="yes"> YES
  <input type="radio" name="attending" value="no"> NO

  <button type="submit">
    Send
  </button>

</form>
```

Controls

Button to submit

Angular Forms

- Angular creates an `NgForm` component for every `<form>`
  - Fires an event call `ngSubmit` in response to the submit
  - Form component is called `ngForm`

Event fired by `NgForm` component when button (submit) is pressed

ngForm

```
<form (ngSubmit)="processForm()">

  <button type="submit">
    Send
  </button>

</form>
```

A `NgForm` is instantiated and mapped to a form

Forms - NgModel

- Annotate form fields `<input>` with `ngModel` directive
- Allow `NgForm` to manage them as controls
- Every field must have a unique name

```
<input type="text" name="email" ngModel>
```

Form

```
<form (ngSubmit)="processForm()">

  Name: <input type="text" name="name" ngModel>

  ...

  Attending:
  <input type="radio" name="attending" value="yes" ngModel> YES
  <input type="radio" name="attending" value="no" ngModel> NO

  <button type="submit">
    Send
  </button>

</form>
```

Template Reference

- A variable that references a HTML element

```
<h1 #h1Element>hello, world</h1>

<form #form>...</form>
```

- Assign the template reference on a `<form>` to `ngForm` object
  - Access to the form when it is submitted

```
<form #form="ngForm" (ngSubmit)="processForm(form)">
  ...
</form>
```

Processing Form

```
<form #form="ngForm" (ngSubmit)="processForm(form)">

 Name: <input type="text" name="name" ngModel>


    export class RSVPComponent {

      processForm(form: NgForm) {
        const name = form.value.name;
        ...
        form.reset();
      }
    }
```

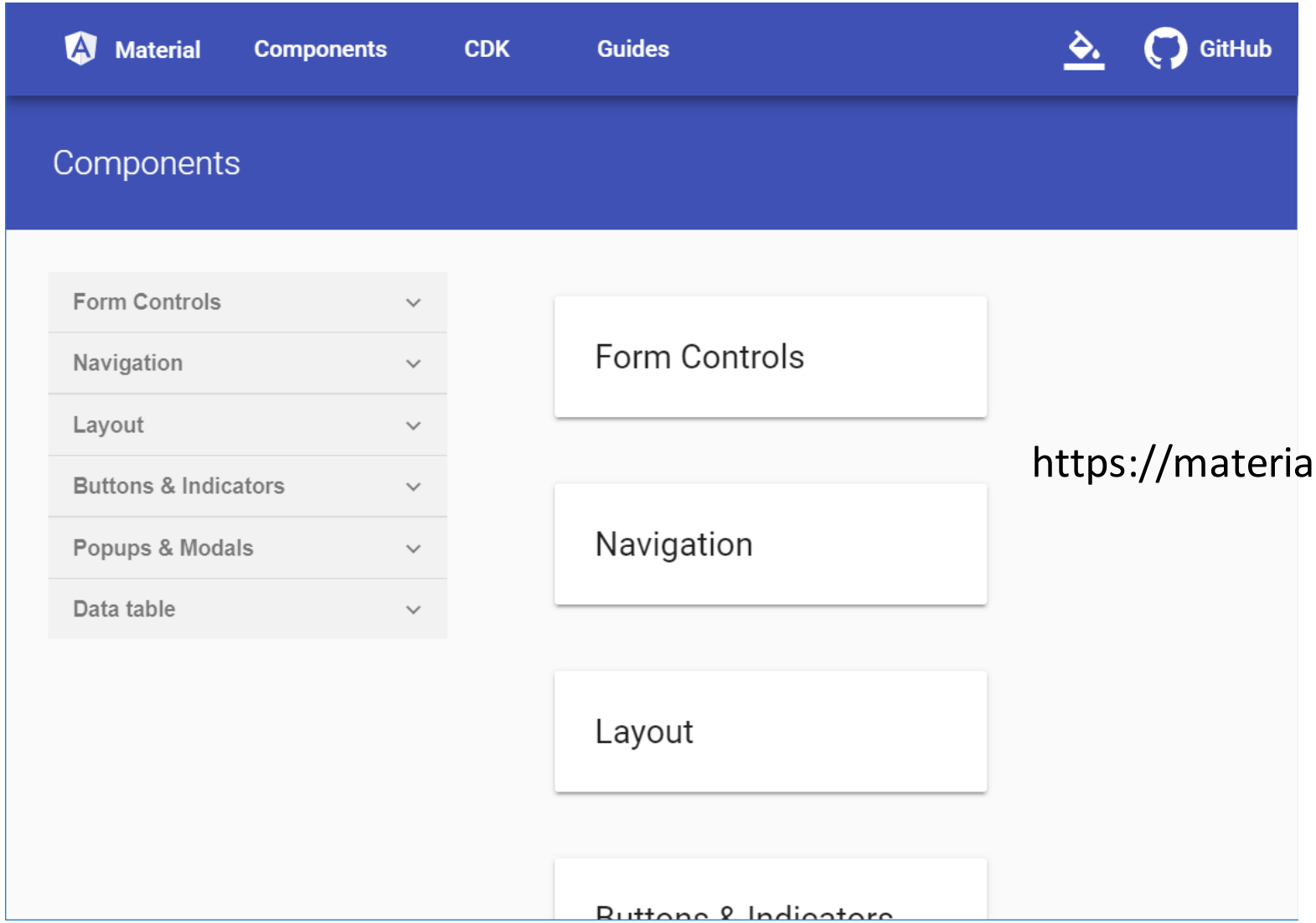
Pass the form into the event handler

Clears the values in the form

Angular Material

- Set of UI components for Google's Material Design Specification
- Consist of Component Development Kit and Material components
  - Dependent on animations and hammer.js
- Angular Materials Setup
  - See https://material.angular.io/guide/getting-started for details
- Steps
  - Install `@angular/cdk`, `@angular/material`, `@angular/animations`, `hammerjs`
  - Import `BrowserAnimationsModule` in `app.module.ts`
  - Select a theme from `@angular/material/prebuilt-themes`
  - Import `hammer.js` in `main.ts` for gesture support
  - Add Material icons

Angular Materials Documentation Page



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  - Eg <button mat-button>, <mat-icon>
- Almost every component is in a separate module
  - Need to import module to unlock component
- Example: `mat-button`, `mat-raised-button`, `mat-fab`
  - From `MatButtonModule`

Using Angular Material Components

```
import { MatButtonModule } from '@angular/material/button';
import { MatIconModule } from '@angular/material/icon';
const MATERIAL = [ MatButtonModule, MatIconModule ];
@NgModule({
   imports: MATERIAL,
   exports: MATERIAL
})
export class MaterialModule { }
```

Keep Material module imports in a separate module

```
import { MaterialModule } from './material.module';
@NgModule({
   imports: [ BrowserModule, MaterialModule ],
   ...
})
export class AppModule {
```

Import `MaterialModule` into the `AppModule`

Example - Buttons

Press

```
<button type="button"
     mat-button>
   Press
</button>
```

Press

```
<button type="button"
     mat-raised-button>
   Press
</button>
```

Press

```
<button type="button"
     color="primary"
     mat-raised-button>
   Press
</button>
```

```
<button type="button"
     mat-icon-button>
   <mat-icon>favorite<mat-icon>
</button>
```

```
<button type="button"
     color="accent"
     mat-raised-button
     mat-icon-button>
   <mat-icon>favorite<mat-icon>
</button>
```

Coffee

```
<button type="button"
     color="warn"
     mat-button>
   <mat-icon>
     free_breakfast
   <mat-icon>
</button>
```

Form Field

`mat-form-field` are used to wrap `input` and `textarea`

```
<form #form
   (ngForm)="process(form)">

  <mat-form-field>
    <input type="email" name="email"
         placeholder="Please enter your email"
         ngModel matInput>
  </mat-form-field>

</form>
```

Please enter your email

Blur

Please enter your email

Focus

Radio Button

Yes No

```
<mat-radio-group name="attending" ngModel>
  <mat-radio-button value="yes">
    Yes
  </mat-radio-button>
  <mat-radio-button value="no">
    No
  </mat-radio-button>
</mat-radio-group>
```

Select

Guest

```
<mat-form-field>
  <mat-select placeholder="Guest" name="guest" ngModel>
    <mat-option *ngFor="let g of [0, 1, 2, 3]"
        [value]="g">
      {{ g }}
    </mat-option>
  </mat-select>
</mat-form-field>
```

Checkbox

☐ Yes, I wish to receive newsletter

```
<mat-checkbox name="newsletter" ngModel>
  Yes, I wish to receive newsletter
</mat-checkbox>
```

Checkbox - Multiple Values

Diet:

☐ Fish ☐ Meat ☐ Vegetables

MatCheckboxChange
is the event object

```
<mat-checkbox ngModel (change)="diet[0] = $event.checked">
  Fish
</mat-checkbox>
<mat-checkbox ngModel (change)="diet[1] = $event.checked">
  Meat
</mat-checkbox>
<mat-checkbox ngModel (ngModel)="diet[2] = $event.checked">
  Vegetables
</mat-checkbox>
```

```
diet = [ false, false, false ]
```

Array elements will be set to true when checkbox is selected

Date Picker

- Datepicker component uses moment for date and time
  - See https://momentjs.com
- Will have to install moment adapter

```
npm install --save @angular/material-moment-adapter
```

- Add to app.module.ts

```
import { MatMomentDateModule }
    from '@angular/material-moment-adapter';
```

Date Picker

```
<mat-form-field>

  <input matInput
    [matDatepicker]="datepicker"
    placeholder="Date of birth"
    ngModel name="dob">

  <mat-datepicker-toggle matSuffix
    [for]="datepicker">
  </mat-datepicker-toggle>

  <mat-datepicker #datepicker>
  </mat-datepicker>

</mat-form-field>
```